

AUSTRALIA'S NUMBER ONE ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

OCTOBER 1983
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32-PAGE
ROD IRVING
CATALOG



BUILD THIS
VIDEO ENHANCER

**SUPERWEAPON
SOFTWARE PROBLEMS
SPEED SENTRY FOR CARS**

**YAMAHA R100
RECEIVER REVIEWED**

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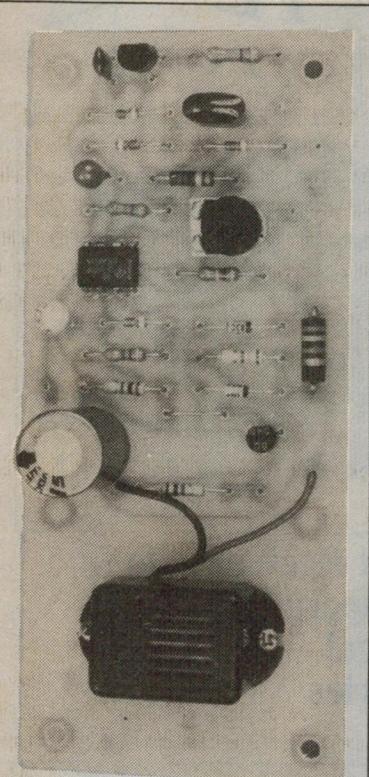
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE

ELECTRONICS AUSTRALIA

Volume 45, No 10, October, 1983

On the cover

Our covers features the video enhanced which is described on page 52. It won't cure ghosts, snow, or RF interference, but it can sharpen the edges of a clean picture and make it just that much better. And it won't cost a fortune!



Save petrol, save wear, and don't get fined. Keep your speed down and drive within the law with our Speed Sentry. Details on page 60.



One of the Fluke series 70 multimeters described in the equipment review on page 16. They feature both digital and analog read-outs.

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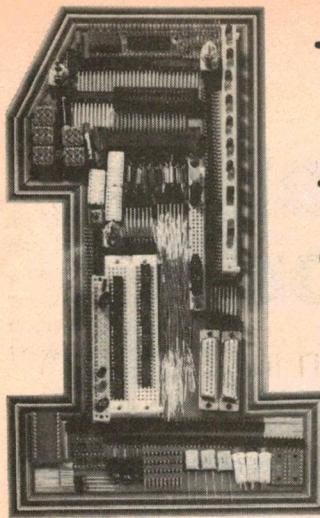
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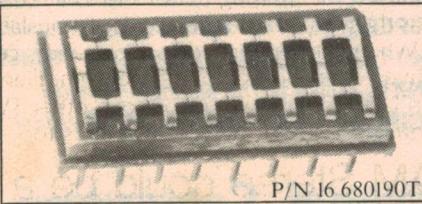
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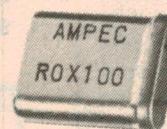
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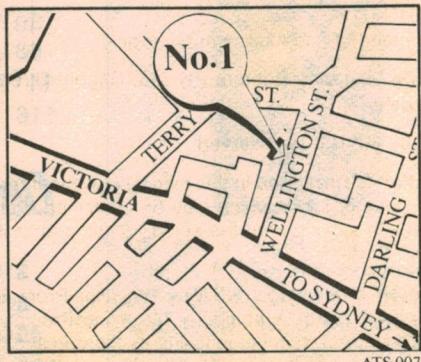
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Editorial Viewpoint

Channel 0 to cease transmission in 1984

Amateur radio operators will be delighted. The Minister for Communications, Mr Duffy, has decided that the temporary arrangement whereby SBS Multicultural Television began transmissions on VHF channel 0 and UHF channel 28 will indeed be temporary and will cease at the end of 1984. And a good thing too. From the end of 1984 multicultural television will be available only via UHF channels 28 or 54.

Channel 0 never was a good allocation for television, for a number of reasons. For a start, it is slap up against the six metre amateur band from 52 to 54MHz and so is subject to mutual interference with amateur transmitters. Second, since it is the lowest television channel it is the most prone to interference from CB on 27MHz and to electromagnetic interference from high voltage mains transmission lines.

Another major source of interference is the brushes and commutator of the ubiquitous universal motor used in countless consumer appliances such as food mixers and electric drills. These all do their bit lessening in viewer enjoyment when watching channel 0.

Add to that the antenna problem. Sydney viewers did not have antennas cut for channel 0 but it was not until transmissions began that the problems arising from this began to be recognised. Any TV antenna cut to suit Sydney conditions, where Channel 2 used to be the lowest channel, can be expected to be "down the gurgler" as far as channel 0 is concerned. For most viewers this simply meant that they received a snowy and unwatchable picture. But in strong signal areas the falling low frequency response of the antenna could result in "picture pulling" because the sync amplitude of the recovered video signal was reduced.

But now that channel 0 is to cease operation not everyone in Sydney will be consoled by the fact there is a much improved channel 28 signal now being radiated from the top of the channel 2 tower at Gore Hill. The fact is that the temporary introduction of SBS on channel 0 in 1980 was a backward move and has probably delayed the phasing out of VHF-only sets on the Australian market. And that in turn has delayed the wider use of UHF translators in difficult metropolitan reception areas.

Whatever happens, one thing seems certain. Multicultural television is doomed to have a small portion of the viewer audience while ever it is condemned to go it alone on UHF. The answer is to move other TV channels into the UHF bands. Perhaps we could clear TV from the FM bands too.

AM Stereo could be a schemozzle

No doubt many readers are aware that AM stereo transmissions are already being carried out experimentally by quite a few stations and the final go ahead from the Department of Communications is expected late this year or early next year. But what system will we have?

Apparently, the AM stations expect that we will inherit the same botch-up as in the USA whereby four different systems of AM stereo encoding are allowed or, to be more correct, no one system is preferred by the FCC. Wouldn't it be good if the Dept of Communications decided on one system and one system alone? This would greatly simplify the design of a decoder and may even make local manufacture of receivers a possibility.

Leo Simpson

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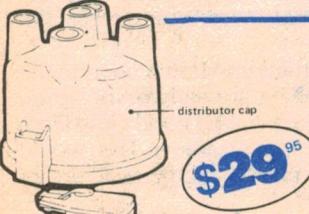
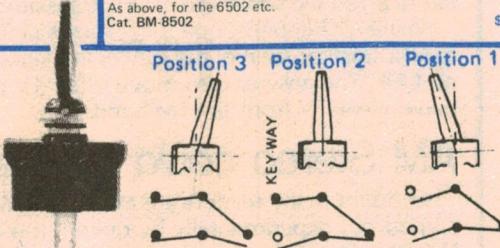
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0 - 250 0 - 1000
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AT 20,000 ohms/volt

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0 - 50K 0 - 25
0 - 500K 0 - 250mA

dB: 20 to +22dB
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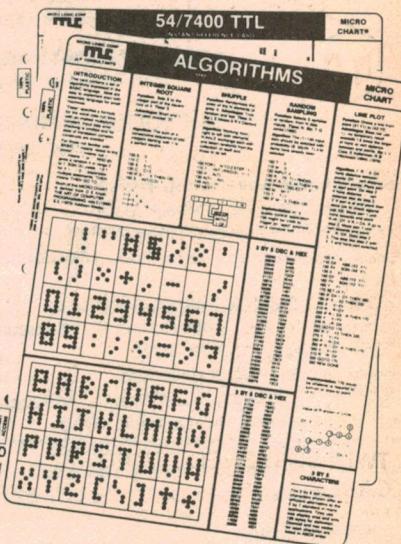
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As above, for the 6502 etc.

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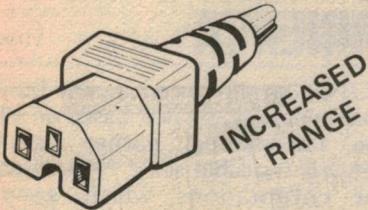
Jaycar has had designed a high quality, high performance Video Enhancer which is specifically for the Australian 625 line 50 frame PAL-D system.
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Most imported equipment these days now uses IEC-320 style AC power inlet connectors. Indeed, the electronics mags will soon be specifying these connectors on many of their mains powered projects to simplify (and therefore make safer) mains wiring. Jaycar now stocks a range of ELECTRICITY AUTHORITY APPROVED mains line cords. We have them in straight entry, left and right entry with and without standard 240V mains moulded plug. Each cord is a generous 2 metres long and is rated at 7.5 amp continuous.

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PS4306	LINE CORD STRAIGHT ENTRY WITH 240V PLUG - 2M	\$4.95
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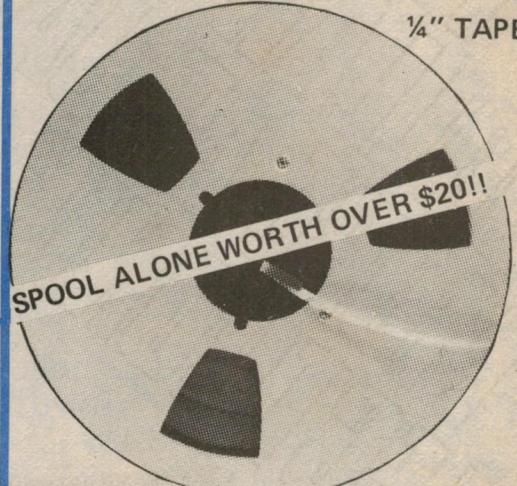
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News Highlights



Neville Williams' Retirement Dinner

Pictured above is Neville Williams and his wife, together with Peter Gaunt (left), Magazine Promotions general manager, and publisher Jules Zanetti, at the

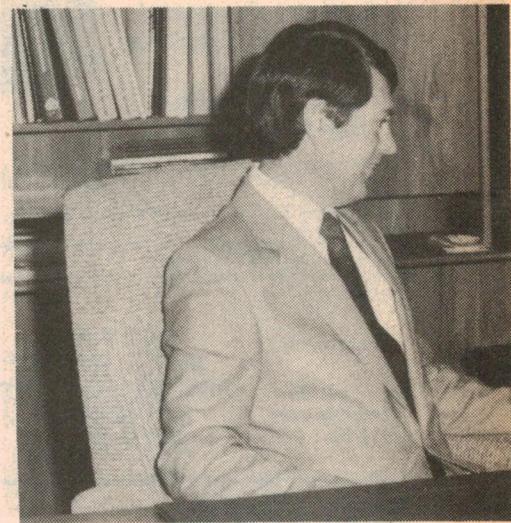
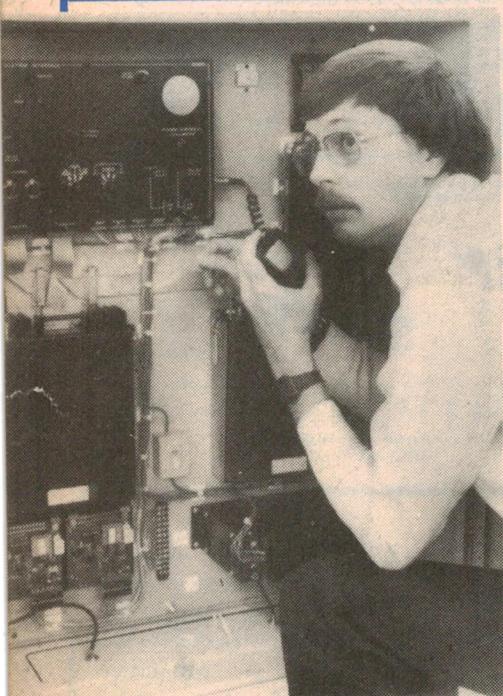
retirement dinner held for Neville on July 27, 1983. Around 140 people were present, with many having come from interstate.

New UHF systems

The State Electricity Commission of Victoria is about to replace several existing VHF mobile radio systems with new UHF systems costing some \$1.2 million. Main sites for the new systems will be the Commission's open cut mines at Morwell, Loy Yang, and Yallourn in the La Trobe Valley.

The system will comprise 600 mobile units and 15 base/repeater stations, to be supplied by Plessey Australia Pty Ltd. The mobile units will be the Plessey MTR 8000 frequency synthesised sets. The new system will be linked to the Commission's private automatic branch telephone exchange, giving personnel direct telephone access to Commission vehicles. Vehicles will be called via a selective calling system.

Plessey will supply some of the equipment from its Meadowbank, NSW, factory, but the major portion will be manufactured in Victoria.



MIDAS begets MINERVA

OTC has introduced a new business communication service, based on Midas, the international packet switching network available since 1979. Intended for corporations which generate substantial overseas intra-company confidential correspondence, the new service — Minerva — can be operated via any computer terminal and modem anywhere there is a telephone and mains power.

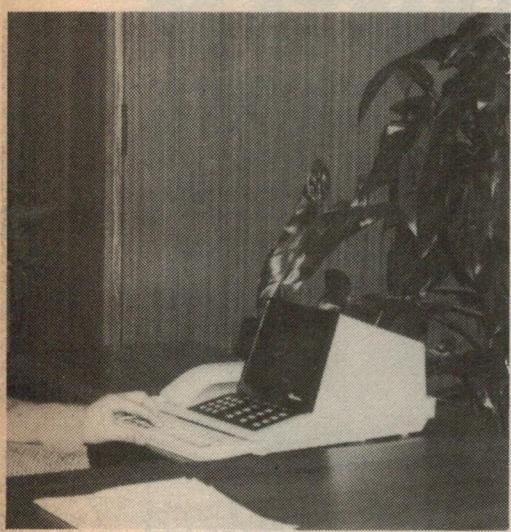
The service is operated by the executive typing the message, in plain language, into his desk-top terminal. The message is then transmitted into the Minerva high security centralised computer system in Washington, DC.

Pollution Alert

It seems that high technology industries are not necessarily environmentally benign, judging from reports of recent pollution alerts in California's "Silicon Valley".

Solvents, detergents and acids used for etching and cleaning chips have leaked from the underground storage tanks maintained by many companies and have permeated the area's ground water. Several communities in and around the 200 square kilometre "high-tech" area depend on wells for their water and are seriously threatened by the toxic chemicals.

Ten wells have already been closed in south San Jose after they were found to be contaminated with trichloroethane, a degreasing solvent which can damage the central nervous system, liver and heart. Fairchild Camera and Instrument Corporation, with premises in San Jose,



The message is then available only to the addressee, who may be anywhere in the world, and who can interrogate the Washington computer, at any convenient time, by using a special security code.

Any modem and terminal may be used, whether it is a word processor, personal computer or specialised communications terminal. In the near future, Minerva will be able to connect with Telex services.

There is no registration fee or minimum monthly bill for the Minerva service. Users may buy or lease a terminal if they don't already have one within their organisation and then pay only for the hourly use they make of the service.

Further information may be obtained from the Overseas Telecommunications Commission.

has already spent \$US14 million trying to alleviate the problem and now faces a multi-million dollar law suit brought by 266 residents of the area.

Since the Fairchild incident, local authorities have asked other companies to check for leaks from storage tanks. So far 67 firms have reported leaking tanks involving similar solvents.

EIA name-change

The former Electronic Importers Association has adopted a new name, the Consumer Electronics Suppliers Association (CESA). The association was formed under the original name in 1973 to prepare a submission to the government on policy matters affecting the import of consumer electronic goods.

Since 1973 the association has expanded considerably and now includes Australian manufacturers as well as importers. The new name more accurately reflects the current position.

The ultimate photocopier?

Special equipment has been developed by the British Library to copy valuable and aged documents without damaging the paper or the spine of books.

The "digital copier" cradles the selected page at a convenient angle and raises it towards a scanning head that contains a 2056-element high resolution camera and a high intensity lamp designed to keep ultraviolet and infrared emissions to a minimum.

Heat and UV radiation are two major enemies of paper, and many historic documents cannot be copied by conventional means because of the possibility that the light sources used may hasten deterioration of the manuscript.

The camera of the image digitiser scans across a page and converts the image to a stream of digital information. The data can be transmitted to a printer for reproduction of copies or to a computer memory for storage. An interface is also under development which will allow the digitised image of the page to be



transmitted to a receiver anywhere in the world.

Production of the first 10 image digitisers is planned for this year and the demand from libraries, universities and historical institutions is expected to create a market for up to 100 machines a year in the near future.

Telcom buys local optical fibres

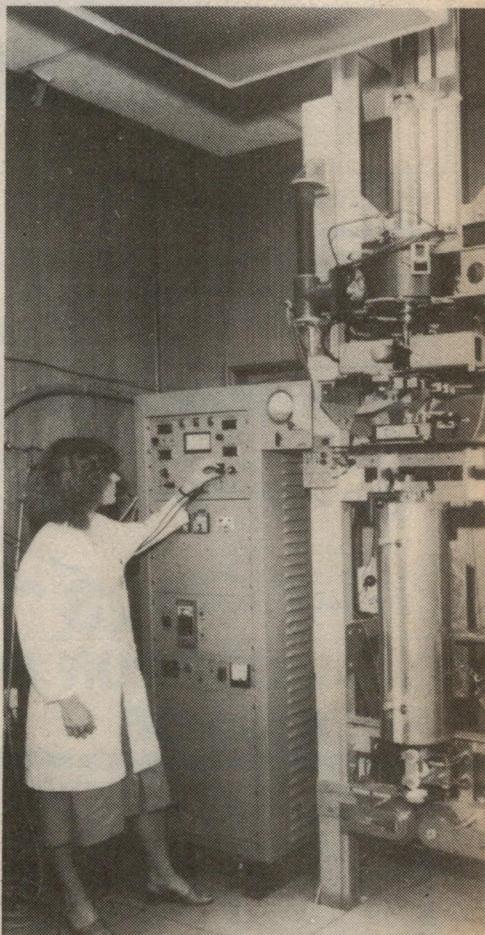
The optical fibre industry in Australia has received a major boost following the awarding of a contract to Amalgamated Wireless (Australasia) Limited.

AWA will supply 160km of optical fibre to Austral Standard Cables Pty Ltd, who will make it up into a cable for a Telecom connection between the Sydney suburb of Waverley and the main city telephone exchange seven kilometres away.

This is the first wholly Australian-manufactured fibre cable to be used by Telecom, which is the only Australian organisation or company so far to use optical fibres in quantity. Until now, fibre cable used by Telecom has been made in Japan, or has contained Japanese fibre.

AWA believes that the contract is an important step forward in the local optical fibre industry. After 11 years of research, AWA claims its product equals anything produced overseas.

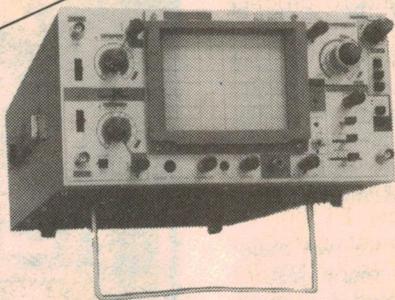
Fibre cables have many important advantages over wire cables. They are interference-free and may be installed without special precautions in electrically noisy environments. Optical fibres are also smaller, lighter, easier to install, and have a greater information carrying capacity.



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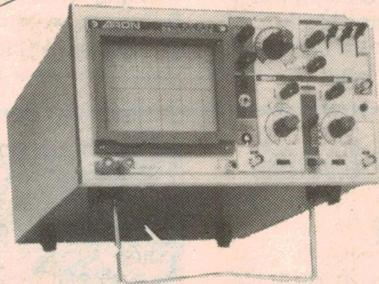
All these scopes are dual trace and incorporate the latest features such as high brightness rectangular CRTs.

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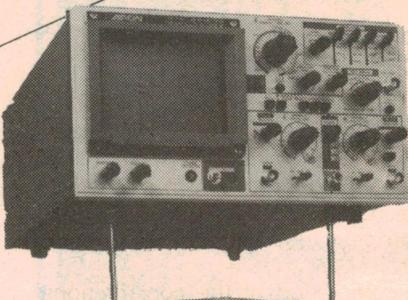
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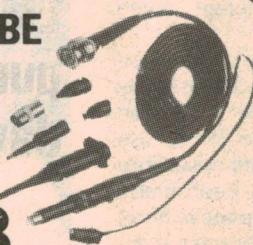


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News Highlights

First test of European Torus

The Joint European Torus (JET) was operated for the first time at Culham, Oxfordshire, England during the weekend of June 25-26, 1983. This marks the culmination of a five year construction program, costing some £175 million (\$A300 million) at current prices, which has been carried out by a team from the 11 European countries participating in the project.

The completion of the constructional work has enabled a program of experiments to commence, scheduled to last for seven years. These experiments will help to determine the feasibility of using nuclear fusion reactions to produce a long term source of energy. However, several further steps will be required beyond the JET work before a commercial nuclear fusion power station could be built in the next century, perhaps around the period 2020 to 2030.

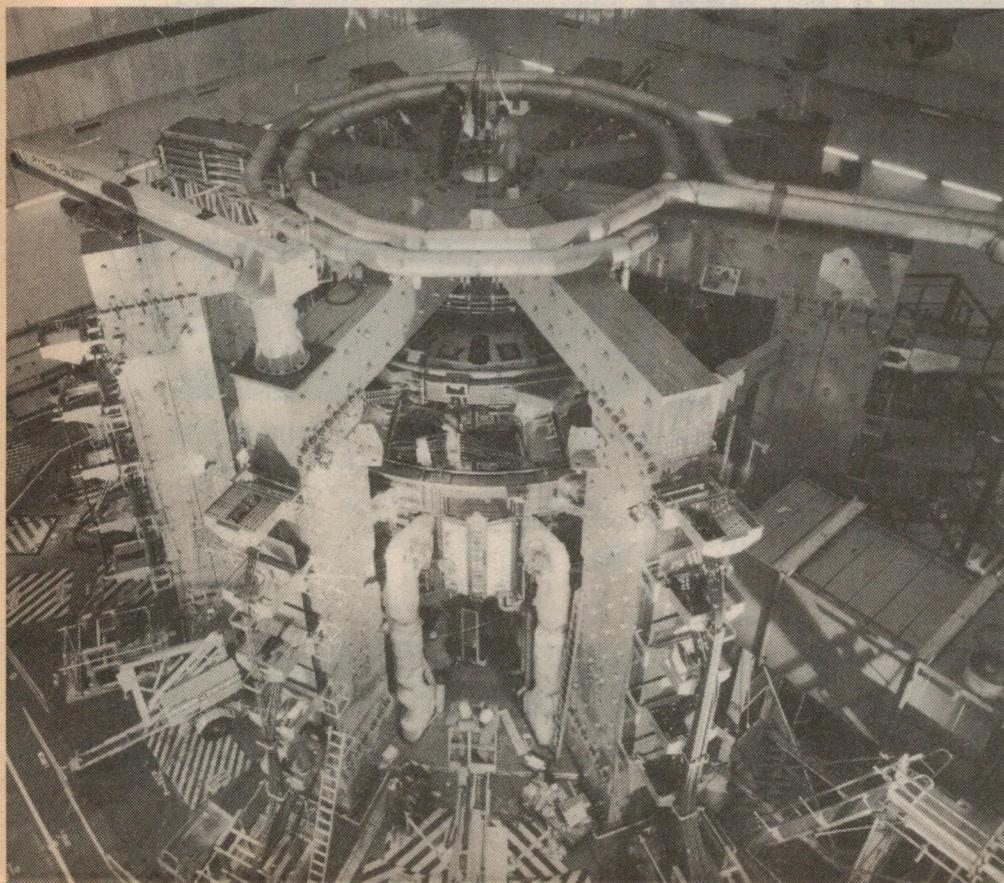
In the initial experiments a current of 60,000 amps was passed through hydrogen gas at a low density for $\frac{1}{10}$ second to convert the gas into a hot ionised plasma. It is planned to increase this current progressively up to a maxi-

mum of about five million amps. In the later years of the experimental work it is intended to use additional heating systems providing some 25 megawatts to try to raise the temperature of the plasma to about 50 million °C for a period of about 10 seconds. It is then hoped to replace the hydrogen gas with a mixture of the hydrogen isotopes deuterium and tritium and to produce thermonuclear reactions which will raise the temperature still further to about the desired 100 million °C required for a satisfactory thermonuclear reaction rate.

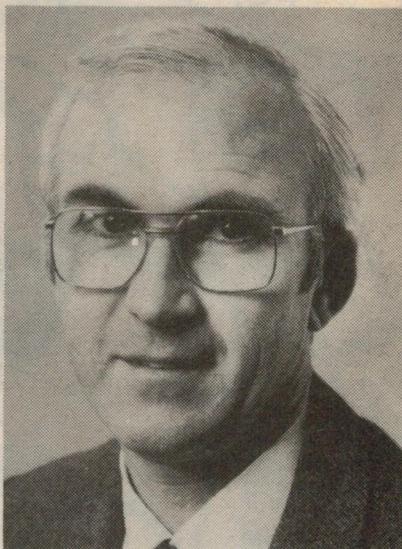
At such temperatures bursts of high energy neutrons are released which will provide the heat required for the generation of electricity. Neither JET nor the American TFTR experiment has been designed to utilise the energy of the neutrons.

JET employs a toroidal-shaped gas vessel in which specially shaped magnetic fields are used to hold the high temperature plasma away from the walls of the vessel. The so-called "tokomak" magnetic field configuration is employed. JET is the largest and the most ambitious tokomak in the world and has been constructed mainly with funds from the European Communities as part of the Euratom fusion program.

JET was set up in 1978 as a joint undertaking for a seven year period with the object of studying plasmas under conditions approaching those required for a commercial fusion reactor. It is hoped temperatures greater than those at the centre of the sun will be reached.



New appointment



Jim Rowe new Marketing Director at DSE

Dick Smith Electronics has appointed Jamieson (Jim) Rowe to the position of marketing director. Jim has spent the last four years as technical director of Dick Smith electronics. Besides developing the first small computer for home construction in Australia, Jim is the author of several well respected electronic books.

Previously Jim was with "Electronics Australia" for 20 years, the last nine as editor.

Electronic Agencies purchased by Jaycar Pty Ltd

On September 1 Jaycar Electronics Pty Ltd, purchased the operations of Electronics Agencies Pty Ltd.

Trading will continue at the previous Electronics Agencies outlets at Concord and York St, City, with both Jaycar and Electronics Agencies products on sale.

The previous Jaycar store in York St, City will close at the end of October and operations transferred to the old Electronics Agencies store at 117 York St.

All outlets will be known as: "Jaycar Electronics incorporating Electronic Agencies".

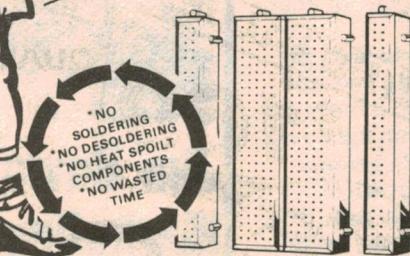


DICK'S 15th BIRTHDAY

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Design easy!



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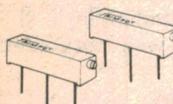
Now circuit designing is as easy as putting a lead into a hole with this superb Protoboard. Designed to accept transistors, ICS, LSI packages, resistors, capacitors, LEDs, trimmers, relays etc. Base board has 290 holes and pack includes two clip-on extensions each of 50 holes. 390 holes in all and you can add on as many more as you require.

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It has been found that a small number of these multimeters may be capable of developing an internal short circuit when used to measure high voltages. In some circumstances this could result in danger to the user.

If you have purchased one of these meters, please return it to the point of purchase, where it will be sent to our Service Department for a free modification to ensure its safety.

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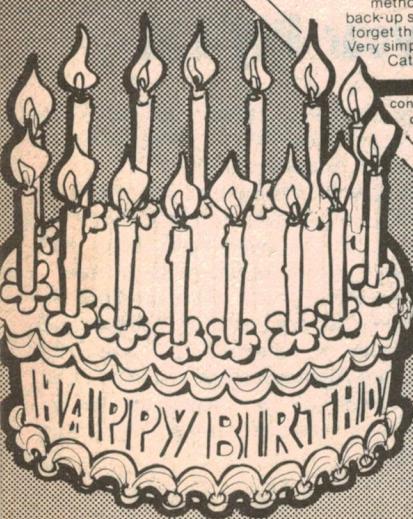
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Need some LED's for your projects? Don't go past these for value!

Type	Cat No	1 - 9	10 up
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DICK SMITH

See Page 98 for



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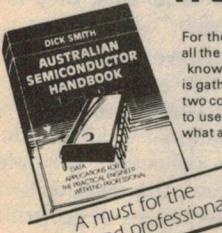
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FEATURES

- Fully self-contained and pre-assembled computer ready for mounting in any petrol carburetted vehicle
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Just like the new model 'luxury' cars, you can have a comprehensive car computer in your car. And it won't cost you an arm and a leg. Just think – it could pay for itself in just a few thousand kilometres. You'll be amazed at what the computer can tell you about your driving!

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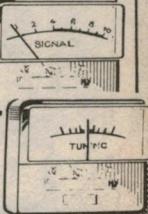
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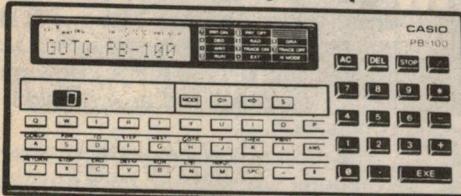
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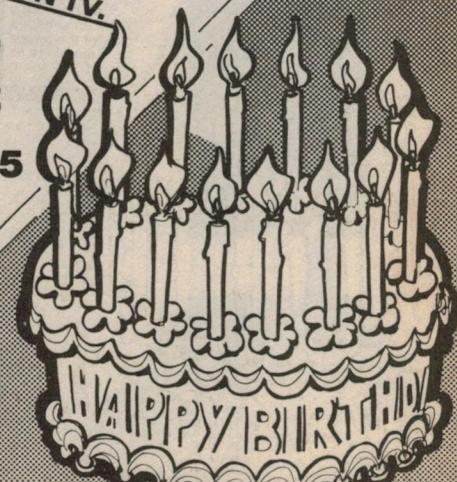
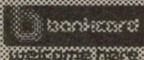
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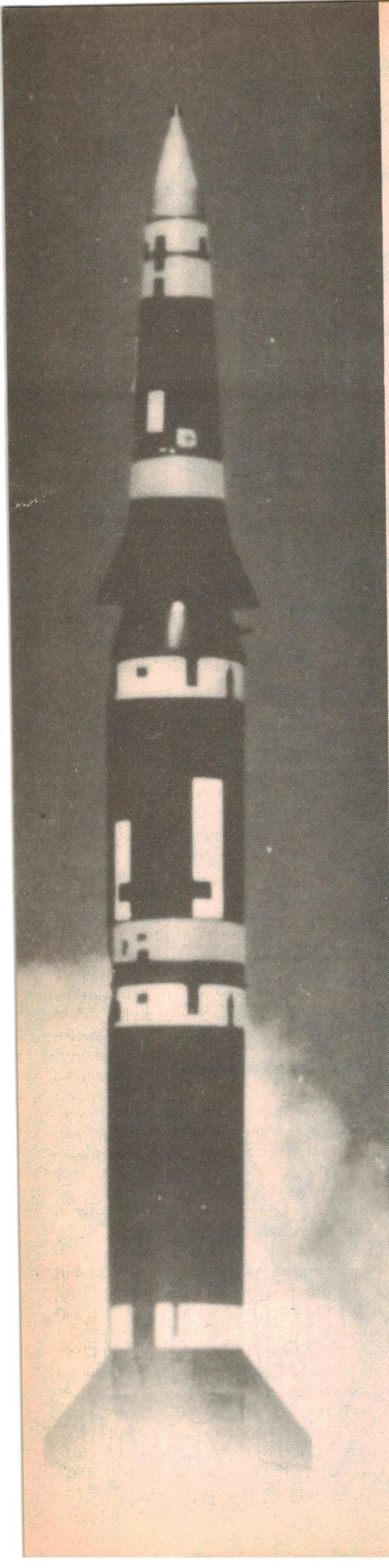
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Superweapon

Weeding the errors out of US Defence Department computer programs that operate everything from missiles to tanks is a frustrating business, but the process is essential.



There were only two little mistakes in the computer program that guided a new missile through its firing test last December. But the mistakes were serious enough to cause the computer-controlled missile to drift from its plotted trajectory, and a human controller had to save the missile from crashing. The result was an expensive delay in a major US Department of Defence project.

Donald R. Greenlee, a specialist in the Defence Test and Evaluation office, uses the incident to illustrate that "in the digital world, it only takes one bit to bring on catastrophe." One of the errors was simply a reversal in sign, a negative where a positive should have been.

To Greenlee, the incident is also a success story. "The test was conducted, and it did what was intended — to reveal a problem," Greenlee says. Laboratory simulations allowed design engineers to duplicate the failure noted in the flight test. This narrowed down the search, and a line-by-line check of the relevant parts of the computer program eventually isolated the mistakes. The computer program was fixed, and subsequent firing tests were successful.

Software errors, mistakes in computer programs, occur frequently. According to Edward Miller of Software Research Associates in San Francisco, during software development every 1000 lines of computer program typically contains 10 to 80 "defects", all of which must be caught somehow. Some programs are millions of lines long.

This problem is a special concern at the Defence Department because almost every system in the current and planned military inventory relies on computers and microprocessors extensively. For example, computers control the targeting and flight of missiles, coordinate and control sophisticated systems installed in high-performance aircraft, and integrate the complex activities of battlefield command. "Consequently, software has become the dominant factor in military systems," says Edith W. Martin, deputy undersecretary of defence for advanced technology. One reason for DOD's increasing reliance on software is that soft-

ware changes are easier and less costly to make than altering the comparable function built into electronic circuits, she says. New threats can be met by making appropriate changes in computer programs.

Software must be reliable, particularly in life-threatening situations, and that means weeding out any errors. However, testing and evaluating computer programs efficiently and effectively is very difficult. Many senior program managers at DOD feel much more comfortable with hardware, such as jet engines or artillery shells, than with computer software. "We know very well how to test an artillery shell. We've been doing it for centuries," says Greenlee. "We know how to condition the thing environmentally — heat it up and freeze it, drop it, and then test fire it. But computer software? You can't even see it, let alone beat it with a hammer or attempt to destroy it. It requires a different intellectual approach."

DOD's concerns were reflected in a recent software test and evaluation conference held in Washington, DC. Sponsored by the National Security Industrial Association, a collection of defence-related companies, the meeting brought together representatives of government, industry and universities to review and discuss experiences and advances in locating software errors. Rear Admiral Isham Linder, Defence Test and Evaluation director, in his keynote address pinpointed two key questions: "How much testing is enough, and how should it be conducted?"

The most obvious method for testing a computer program is to track exhaustively every possible logical branch in the program or to try every possible calculation, but in large programs this method is impractical. Even a simple program with just 10 two-choice branches provides more than 1000 different paths. Anything more complicated could require months of computer time and might generate thousands of pages of output. Who's going to read all the results? Who knows the results are correct? In general, an exhaustive test that

Software Woes

by IVARS PETERSON

covers all the possibilities is impossible.

One way to get around this difficulty is to randomly sample a small portion of the possible paths in a computer program. If enough tests are performed, and all errors found are corrected, then the probability of any remaining errors should be very low. Some software developers even deliberately seed their large programs with a known number of errors. If an independent testing group finds all the deliberately introduced errors and others besides, then the probability is high that practically all the errors in the program have been found.

"That's a far cry from dropping an artillery shell off the back of a truck," says Greenlee.

Another approach is to construct test cases that pinpoint specific types of errors known to occur during the course of software development. However, developing a comprehensive set of suitable test cases can take as much effort as writing the computer program itself. More theoretical methods, like mathematical "proofs of correctness", have turned out to be too complicated to apply in real situations or restricted to a few special cases.

Part of the problem is that computers are usually brought in when the mental task is too hard for the human user to do in sufficient time. "Therefore, you're trying to test something which, by definition, is mentally challenging," says Greenlee. "You don't sit down and check out a complicated piece of software on the back of an envelope."

"You don't sit down and check out complicated software on the back of an envelope"

"Testing is hard work," Miller told the conference participants, and no one disagreed. Victor R. Basili of the University of Maryland concluded his presentation, "It is almost frightening how many open questions there are in a field where we have been working so long."

Within DOD, software development "ranges from a reasonably effective, disciplined approach in a few systems to near chaos in others," says Martin. A US Navy study, for example, reveals 13 different mathematical systems in use for steering an airplane from one place to another. In the US Air Force, as much as 90% of computer program lines are coded in a primitive, difficult-to-decipher computer language. In many situations,

programmers find it easier to start over rather than try to modify existing software. The US Army, in a 1978 survey of about 100 battlefield systems, found 34 different versions of essentially the same computer, each operated by a different computer language.

This diversity creates headaches for those responsible for testing and upgrading the systems, and produces problems on the battlefield when one computer has to communicate with another.

Any standardisation program to improve "interoperability" and make testing easier faces immense obstacles. For instance, Captain David Boslaugh of the Naval Material Command pointed out that the Navy has about 450 different systems and subsystems with "embedded computers". The number of computers in use is doubling every two years. About 50 million unique lines of software, in a variety of computer languages, are currently operating active systems. To redo these lines would take years, considerable expertise and at least \$85 billion, said Boslaugh.

Nevertheless, because of DOD's growing reliance on computers, efforts to rationalise the software development process are continuing. Many in DOD, especially in the Army, are counting on a new committee-built computer language, Ada, which is the result of a seven-year DOD-sponsored design effort. Ada promises to help computer programmers work more quickly, with fewer errors, and to allow the development of portable computer programs capable of running on almost any computer instead of just a few models.

The Pentagon has mandated that software for most military systems be written in Ada, and the language will probably be in routine use by 1985. However, Ada's prospects for becoming a standard language outside of DOD and military applications are limited because of doubts about its ability to handle complicated scientific calculations.

Some critics also see Ada as a big, complex language that eats up costly computer memory space. The language offers so many options that, despite the emphasis on programming in "packages" and the use of English-like sentences for computer instructions, Ada would be difficult to learn, they contend.

The Ada approach is part of an effort to bring more discipline to software development. At one time, computer



programmers were akin to magicians, cleverly stringing together chains of logical statements, using whatever tricks they could invent, that somehow got a computer to do what it was supposed to do. Such undisciplined efforts, imbued with programmers' idiosyncrasies, proved difficult to test and modify when they sprang unexpected errors.

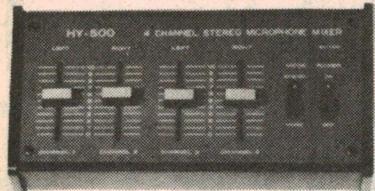
Many conference participants argued that programs had to be written with testing in mind, and that this approach had to be emphasised in the training of programmers. Basili said that a recent experiment he conducted at the University of Maryland showed that students altered their programming styles when they knew their programs were to be tested by an independent reviewer. Several students were apologetic because they had avoided trying anything "funny" and instead concentrated on meeting the specifications and making their programs as clear as possible to the reviewer. To Basili, this shift in attitude was encouraging.

Carolyn Gannon of General Research Corporation in Santa Barbara, Calif, argued that one way of helping both programmers and testers was to compile and study the kinds of errors made during software development. This record would indicate where to look for mistakes, which tests to use to find them and how to handle them. When enough data are collected, these error analyses could be used for developing new tests and for estimating the probability of hidden errors still left in complicated computer programs. Although such data

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Plus of course all models of Fluke Hand held's including their latest 8060B at \$484.00 + Tax. Other instruments include Standard Escort, Anigawa, Trio, Hitachi, Aaron and Goodwill.

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Superweapon Software Woes

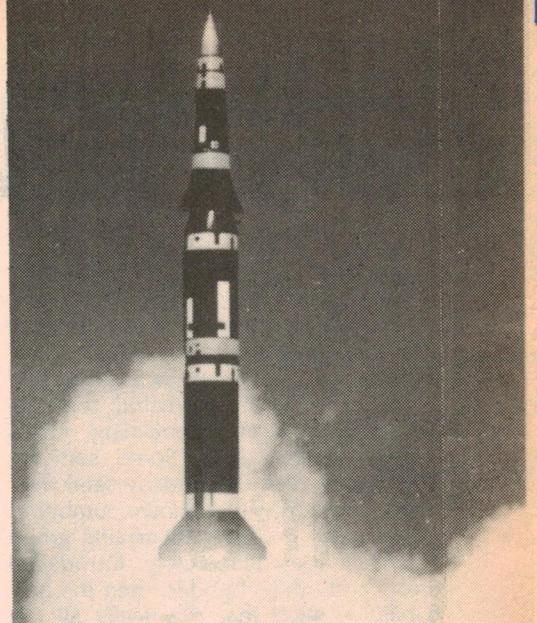
would be valuable, one problem is that programmers are reluctant to admit they make mistakes, and companies don't want the public to know how many errors are made, even if the errors are corrected, Gannon said.

Testing and evaluation already take up as much as half of the budget for software development, so contractors are naturally reluctant to spend extra money on compiling error histories. At DOD, when program budget cuts are necessary, the test program itself (as the "bringer of bad news") often is an early victim. The frequent result, however, is the discovery of surprise problems late in a program or perhaps even on the battlefield. Greenlee says, "The earlier the developer finds deficiencies, the quicker, easier and cheaper it will be to fix them."

Last year at an Electronics Industries Association meeting, Brig Gen Robert D Morgan described "Airland Battle 2000", the Army's evolving doctrine for fighting on future battlefields. "The new doctrine requires continuous action by many elements," he said. "There is no forward edge of the battle area or line of scrimmage. Many battles are conducted over wide areas by units which appear to act independently but, in fact, know their role and strive for a common goal." Computers and satellite communication systems tie together the array of electronics systems that will have to operate in a "chemical, nuclear and electronic warfare environment". In such complicated "systems of systems", finding software errors early becomes even more important.

Colonel Edward Akerlund of the Air Force Systems Command said these coming complex networks introduce whole new areas of problems. Programmers are just beginning to learn how to put together these large systems, and the development of testing procedures lags far behind. He said that tests are needed, for example, to ensure that when part of a system fails, the rest of the system does not go down.

Concerns like this led DOD to initiate the Software Test and Evaluation Project, an effort to develop guidelines for the test and evaluation of defence systems software and to identify useful testing tools that showed promise and were worthy of further research. One of the key issues raised during the early stages of the project involved the amount of testing required. Because it is difficult (expensive and time-consuming, too) to find every error that may exist in a computer



program, one need is for a formal risk assessment procedure that balances the risks of not doing a test against the number and nature of errors likely to still reside in the program. One preliminary recommendation was that testing should be done in proportion to the risks involved if a failure were to occur. Linder noted that a quantitative measure of this risk would be very helpful for high-level decision makers who have to decide whether a certain project should proceed.

This spring, DOD plans to launch another program, a \$250 million, 10-year "software initiative". One aim of the STARS (software technology for adaptable, reliable systems) program is to create a software engineering institute where DOD, in cooperation with industry and universities, can evaluate and demonstrate the usefulness of new programming techniques and integrate these ideas into military systems more quickly. The institute would also train DOD personnel. As several conference participants pointed out plenty of programming and testing tools exist, but the information is hidden in obscure journals, locked in company testing centres or scattered in bits and pieces and applicable only to particular computers and computer languages. Some collecting and sifting of this material would be valuable, they agreed.

Spending time and effort on learning how to catch mistakes reflects a recognition that no human-designed system is perfect. Software errors are as likely to come up in a business program that generates invoices as in a program that is supposed to co-ordinate five space shuttle computers. However, software errors in DOD computer systems, whether in missiles, satellites or at command headquarters, can have drastic consequences. Even one little mistake could be one too many.



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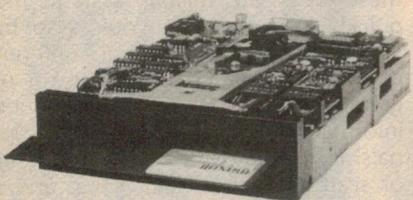


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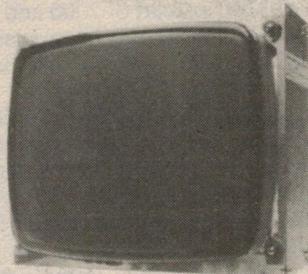
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Fluke re-establishes its leadership in the DVM market

New concept Digital Multimeter

by COLIN DAWSON

Since 1977, Fluke has been a leader in the handheld digital multimeter market. Now, with its entirely new 70 series meters, Fluke is positioned to grab a major share of the market for digital and analog meters.

Digital or analog? The debate still continues years after the introduction of digital multimeters to the "popular" market. The accuracy and instant readability of digitals have won them a wide following, but they still can't give a useful display with a fluctuating input. Or can they? With the new Fluke 70 Series Multimeters, the answer is a definite "Yes".

Combining the best of both digital and analog multimeters, the Fluke 70 Series are a new type of test instrument certain to attract the attention of the electronics industry. With a unique digital/analog display, they are priced to appeal to hobbyists but have features which will suit professionals.

Besides the display, other attractive features are autoranging, full scale readings of 3200 instead of 2000 and, on the top of the line 77 model, a sample and hold function. All in all, very desirable pieces of test equipment.

At first glance, the new Fluke meters look much the same as any other handheld digital — the same rotary function switch, inputs sockets and a liquid crystal display. It's not until you turn one on that you realise things are going to be different. The meters immediately perform a self-test, activating all the segments and annunciators of the display. They have all the expected symbols — V, A and Ω , and of course a low battery indicator. But, running across the full width of the display is a 32-segment bar graph. This is the feature which sets the Fluke apart from anything you've used before.

The bar graph normally indicates a value which is in proportion to the digital display. Set the rotary switch to DC volts to check your car battery. The meter automatically selects the 32V range and the bar graph gives a reading of just over

one third full scale. But for the real test, apply the probes to a changing voltage — a fluctuating power supply or subsonic oscillator. Here's where the bar graph really comes into its own. The segments flicker across the display as quickly as the needle of the fastest analog meter while the digital display is indicating more or less meaningless random values. In fact, the bar graph updates 25 times per second, 10 times faster than the digital display itself. So the bar graph can be used for peaking and nulling measurements where previously a digital meter could just not be used. In this respect the new Fluke is every bit as good as the best analog meters in showing up small fluctuating readings.

The bar graph can also be used to duplicate the analog meter's ability to check capacitors when switched to the "ohms" range. We must qualify this however and say that the typical analog meter is still superior in this respect for capacitor values under $0.1\mu F$. For these very small values, the small kick from the pointer of an analog meter would not be seen on the bar graph display.

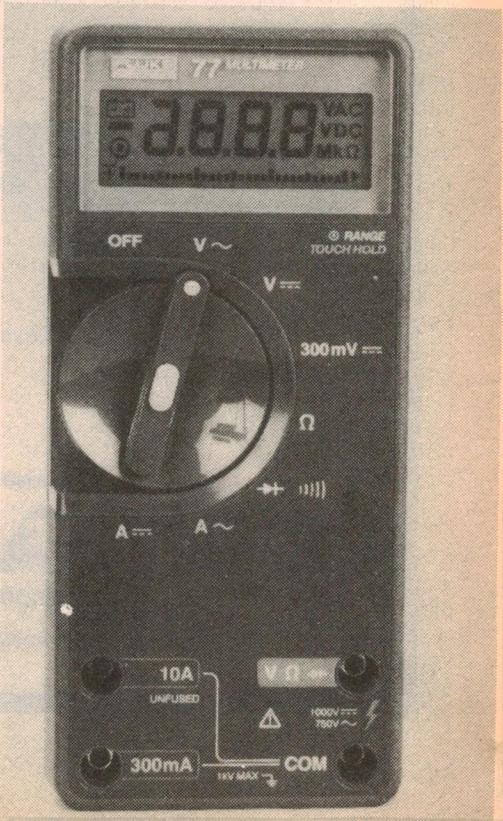
On the particular meter supplied for review, the bar graph is uncalibrated which makes it difficult to interpret absolute values directly from it. This has been rectified on the final production versions where a scale is silk screened onto the display window.

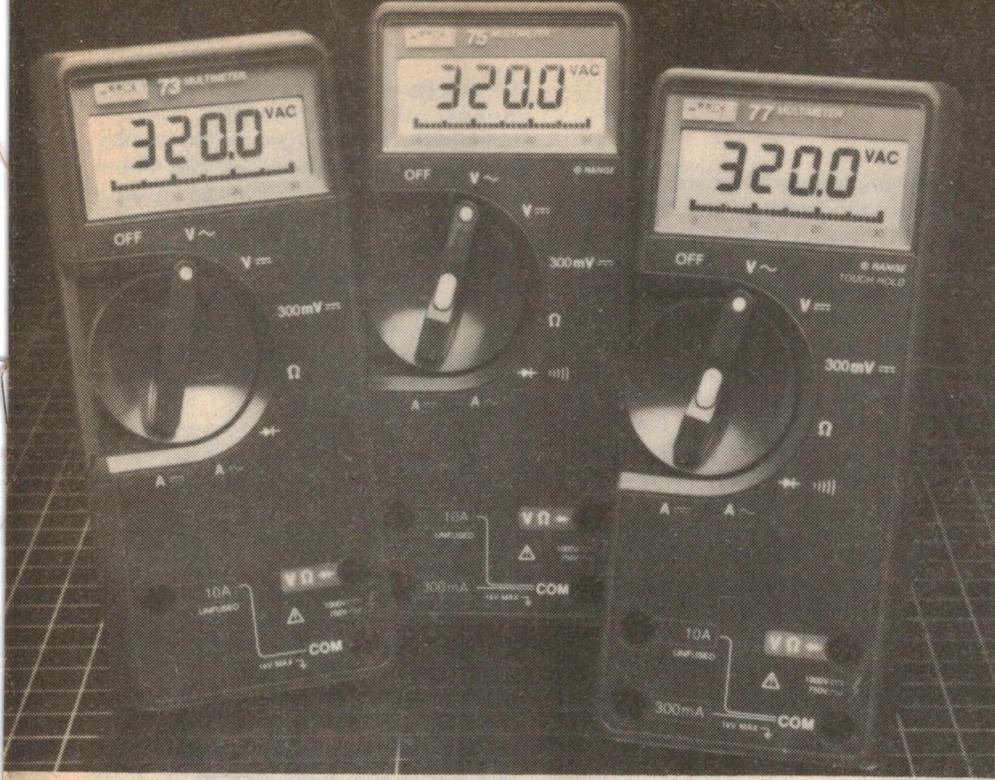
Because the full scale reading of the 70 Series meters on all ranges (except diode test) is 3200, they will in many cases have an extra digit of resolution over a typical DMM. For example, measuring a 240V line most meters will over-range at 200V and have to switch to their 1000V range. This results in a resolution of $\pm 1V$. By comparison, 70 Series meters will remain in the 320V range, giving a resolution of $\pm 0.1V$. A similar situation

would occur when measuring a 24V power supply.

Actually, there are three different multimeters in the 70 Series — the 73, 75 and 77. All three have the new analog/digital display, autoranging and seven input modes. Selecting between the input modes is achieved with the rotary switch on the front panel — each position is clearly indicated with standard electrical symbols. On the 75 and 77 models, the autoranging can be overridden manually by means of a small blue button in the centre of the range selector knob. Whenever this is pressed,

When first turned on the new Fluke 70-series meters go into a self-test routine as shown below.





Shown above are three multimeters in the new Fluke 70-series.

a brief "beep" is emitted from the meter and a special annunciator appears in the display. Repeatedly pressing the button causes the decimal point to shift (with another beep at each shift). If the button is held for one second, the meter reverts to autoranging (with two beeps) and the annunciator disappears.

The beeps are provided by means of a small piezoelectric buzzer (not fitted to the 73 model). As you may have guessed, it is used quite frequently. In

These Fluke meters are supplied with a plastic holster which can be used in a number of attitudes.

fact, some sort of audible indication is given whenever the rotary switch is operated or the button is depressed, and for a lot of other operations as well!

The most obvious use for the buzzer is in the role of continuity tester. This is realised in the diode test position where a resistance of less than 100Ω in the test circuit corresponds to a short circuit. This causes the buzzer to sound continuously. If the test component has a forward voltage drop of between 0.1

and 0.7V, it registers as a good diode and a half-second beep is emitted. Forward voltage drops of up to 2V are displayed so that LEDs can also be tested.

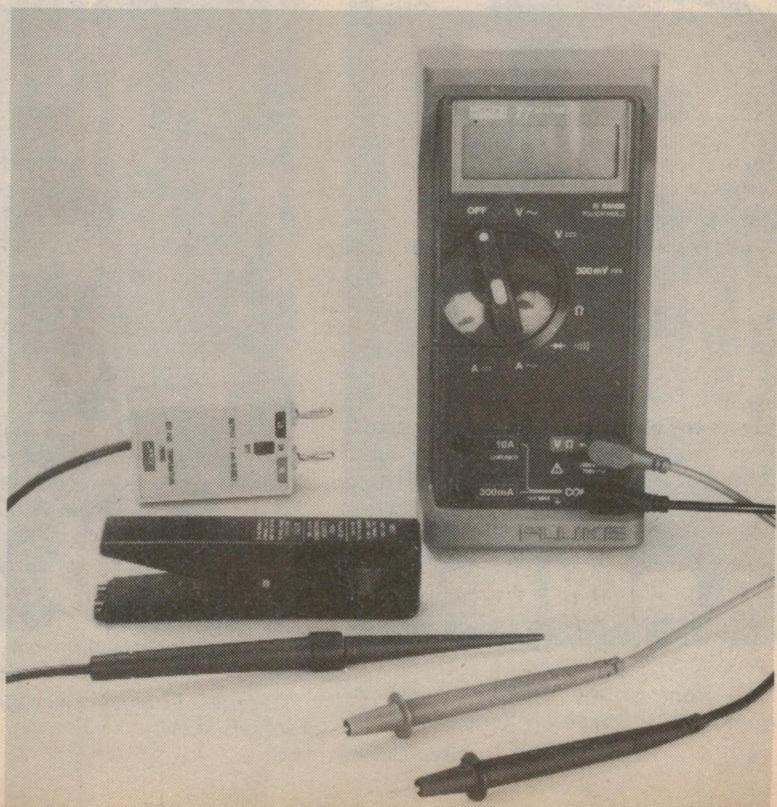
A beep emitted after the power-on self-test signals that all systems are OK. Impressed? There's more to come!

On the 77 model meter, Fluke have a function called "Touch-hold", for which there is a patent pending. Arm the meter, set it to any range and it locks onto the first steady reading. This is perfect for those awkward situations where you really should be watching the probes rather than the display. To let you know that it has locked onto a reading, the ubiquitous beeper sounds for half a second.

To enter the touch-hold mode, the button in the selector knob is depressed before switching the meter on and must be held until the self-test is complete, ie, about two seconds. Once a reading has been taken, it is held until the button is depressed again. This clears the reading and re-arms the meter. The meter can be changed from one function to another without leaving the touch hold mode. In fact, it is only possible to exit this mode by switching the meter off.

There is a wide range of accessories available for the 70 Series meters which will adapt them for use in many specialised applications. Undoubtedly, the most universal accessory is the plastic holster. This is made of flexible, shock absorbing plastic and greatly enhances the versatility of the meter — set it upright on the bench, hang it from

A number of accessories are available for Fluke multimeters such as these current and temperature probes.



New concept Digital Multimeter

your belt, use it to hold or stow the test probes. It even comes with a nylon belt which stows in the back of the holster when not required.

Other accessories include a temperature sensing probe (-50 to 150°C), an RF probe for measuring signals up to 500MHz, a high-voltage probe for voltages up to 40kV and a current transformer probe. Full specifications of these accessories are provided in the 70 Series Multimeter brochures.

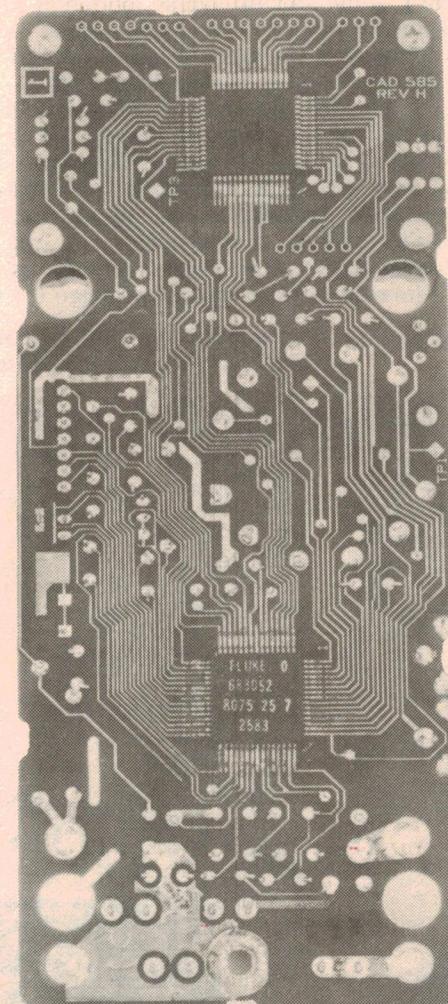
First glance inside the multimeter revealed mostly conventional components such as fuses (two), battery and function switch. The only unusual item was an encapsulated resistor array which looked like a strip of white cardboard mounted edge-on to the printed circuit board. It is interesting to note that there was no wiring at all in the multimeter. Everything — even the battery connectors — mounted directly

on to the printed circuit board.

Removing the larger of the two fuses (600V, 3A) reveals the printed circuit board retaining screw. Once this is removed, the board slips easily out and, yes — there they are — two special ICs. Each of the packages is 13mm square and has 60 pins — 15 along each side. Spacing of the pins is microscopic, at about 0.75mm. In fact these ICs were developed by Fluke specifically for the 70 Series multimeters and they provide most of the high tech facilities.

The printed circuit board is double sided and solder masked. Combine this with the multitude of fine tracks on the underside of the board and you have something which looks more suitable for a computer than a multimeter! In fact, there is good reason why the board should look like computer equipment — one of the ICs is a microprocessor with inbuilt ROM!

We were interested to discover that



Two LSI chips with very close lead spacing provide all the features of the 70-series. One is a microprocessor with inbuilt ROM.

the display interfaces to the board by means of compressible rubber connectors. When the plastic display shell is screwed to the board, the rubber is compressed, bringing minute metallised conductors into contact with the board. Something unusual at every turn with this device!

On reassembly, we noticed that the buzzer element is mounted on the back panel and also has rubber connectors. A spare fuse (250V, 630mA) is mounted inside the front cover.

Basic DC accuracy is $\pm 0.7\%$ for the 73 meter, $\pm 0.5\%$ for the 75 and $\pm 0.3\%$ for the 77. The 9V battery (Eveready 216 type) has an expected life of 2000 hours in all models. Combine this with the automatic power-down facility, which puts the meter into "standby" mode after one hour of non-use, and battery changes should be few and far between.

So that's the Fluke 70 Series multimeters, from the technical point of view at least. But what are they like to use? We can state without hesitation that the bar graph type display is a big improvement over conventional DMMs. Its ability to track quickly changing signals makes it a useful test instrument in conditions that would leave others floundering.

The only area of performance which we had any cause to complain about was the diode test. The current at less than 1mA is too low. This gives only moderate immunity to parallel resistance when measuring a diode or transistor in circuit. Also, this current is insufficient to illuminate a green LED.

Some staff members felt that the beeper was too intrusive, but this is really a matter of personal preference. It is certainly useful in indicating continuity

The two outstanding features

Two features stand out from the rest as far as the new Fluke 70 Series are concerned: the Touch-hold facility and the bar graph analog display. The Touch-hold facility is similar to the sample-and-hold facility found on some electronic voltmeters of the past but the fact that the measurement is stored as a digital value in the microcomputer's memory makes the process far more elegant.

And the bar graph's fast response certainly will break down reservations that many users have previously had to DVMs. Note that the response of the bar graph is just as quick as a typical analog meter so it would be possible to use the Fluke for very quick "ball-park" measurements while ignoring the digital values completely.

The front of the multimeter can be removed to reveal this internal view.

and capture for the touch hold, but is not really necessary in the other roles. This, of course, is not a consideration with the 73 model which does not have the beeper fitted.

Similarly, some staff members thought that the self test function should be initiated manually — not every time you switch the meter on. However, this only lasts for two seconds and is not likely to prevent the industrious worker from getting on with the job.

A great deal of thought has obviously gone into the touch hold facility of the 77 Model — it works very well. Whether or not you need such a feature depends on the type of repair/troubleshooting you're likely to be doing. For those working in cramped or hazardous

conditions, it would be worth serious consideration.

We also liked the rugged engineering approach in the design of the 70-series — it should take a lot of punishment.

To sum up: a very sophisticated and yet easy to use test instrument. Definitely good value for money if you spend a lot of time measuring electric/electronic circuits.

Recommended retail prices of the Fluke 70 Series Analog/Digital Multimeters: 73 Model \$126.60, 75 model \$148.40, 77 Model \$189.80. Prices include sales tax. Further information is available from Elmeasco Instruments Pty Ltd, Box 30 Concord, NSW 2137. Also offices in Mt Waverley, Adelaide, Brisbane and Perth.

About the Fluke company

Beginning in the basement of John Fluke's Connecticut home in 1948, the John Fluke Manufacturing Co has grown into an international operation with annual revenue of over \$160 million and 2700 employees. The headquarters, occupying a 136Ha estate in Everett (Washington) encompasses a microelectronics laboratory and production facility, and is the administration centre for operations in four continents.

The first product released by Fluke was a power meter. This was sold, in 1949, to General Electric and ever since the Fluke name has been associated with quality test equipment. Traditionally, this equipment has been "upmarket", but it is interesting to follow the progress of Fluke leading to their present assault on the popular market.

In 1952, the company, with a small but growing catalogue of test equipment, moved from Connecticut to Seattle. Three years later, Fluke introduced differential voltmeters, providing laboratory accuracy in portable equipment.

During the period 1958 to 1963, Fluke Manufacturing became a public company and undertook an expansion program, acquiring two companies in related industries. International operations were initiated in 1966, with a move into the European market.

An important new product release in 1969 was the digital voltmeter. These technically innovative meters set the stage for a decade of unparalleled growth.

Electronic test equipment was revolutionised in 1977 with the introduction of the Fluke hand held digital multimeter. Although manufactured by a major semiconductor company, the microelectronics for this meter were actually developed by Fluke, enabling them to produce compact test equipment which outperformed much larger and more expensive models. The ICs used in this meter subsequently became available commercially, with the result that numerous competitors appeared in the hand held DMM market.

Many of the competing models, originating in Japan, Korea and other Asian countries were lower quality instruments, offering reduced accuracy and input protection but at a much lower price.

Fluke continued to improve multimeter technology, releasing the 4½ digit 8060A in 1982. This was aimed at the communications and business machine service markets. However, competitors achieved an increasing share of the lower end of the market and Fluke formulated a new strategy. This culminates in the release of the 70 Series meters this month, bringing Fluke into the popular market with a vengeance.

The 70 Series meters will be manufactured entirely by Fluke. Rather than sub-contract the manufacture of ICs to semiconductor companies, the process will be completed within the Fluke Electronics Park. In this way, Fluke hopes to achieve a significant headstart over its competitors. In anticipation of volume sales, an assembly line has been prepared which has a capacity of 1000 units per shift. This gives a manufacturing potential of up to 400,000 units per year!

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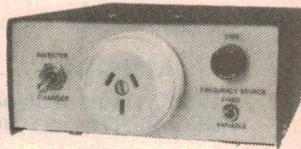
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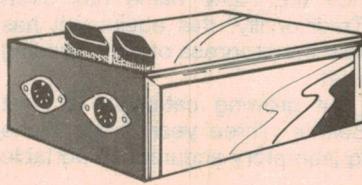


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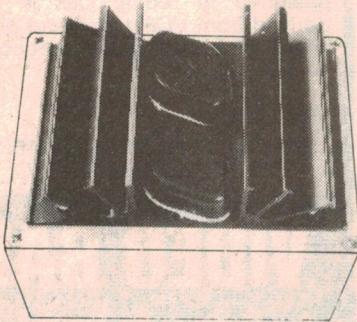


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MAINS APPLIANCE TIMER**

(ETI JULY '82)



Clever new design from ETI, mains appliance is turned on at the press of a button and automatically turned off some preset time later.

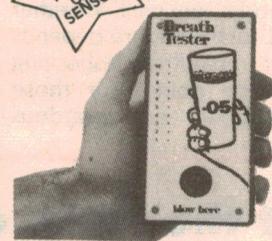
Use for electric blankets, bathroom heaters, patio light. If you inclined to fall asleep while watching TV late at night — this is the kit for you.

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K6265..... only **\$32.50**



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(SEE EA
MAY 1983)

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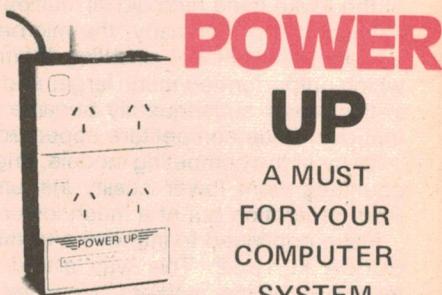


ETI PROJECT

Completely passive project receives microwaves via an antenna which develops a voltage across a detector diode driving the meter. Monitor your microwave oven with this easy to build kit. All components mount on single PCB, including the meter. Genuine Hewlett Packard Hot Carrier Diode supplied.

K1724..... (still only) **\$14.50**

See EA November, 1982



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Just the shot for your Computer System. The Altronics Kit includes case and all outlets.

K6000..... **\$39.50**

VIDEO RF MODULATOR

(SEE ETI OCT. 1981)



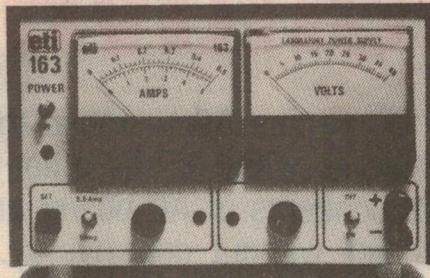
If you cannot afford a Video Monitor for your computer this is the kit for you. Super stable oscillator design and very low modulation distortion. Works with both B & W and Colour TV sets. Suitable for computers, TV games, TV pattern generators or what have you. Deluxe kit featuring heavy duty diecast box for RF shielding. Input and output sockets.

K9760

\$17.50

0-40 VOLT/5 AMP LAB SUPPLY

(SEE ETI MAY & JUNE 1983)



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0-5 A, variable limiting

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<100 mV up to 5 A

Maximum output power 200 watts

Metering Voltage 0-40 V in 1 V divisions

Current 0-0.5 A in 20 mA divisions

0-5 A in 200 mA divisions

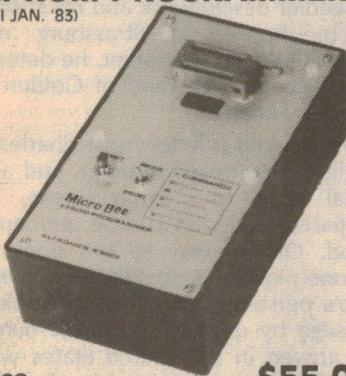
Series regulator design enables design and development of sensitive high gain audio and RF circuitry free from hum and noise sometimes associated with other techniques.

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(ETI JAN. '83)



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(See Review ETI AUGUST 1983)

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(ETI APRIL '83)



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(ETI AUGUST '83)



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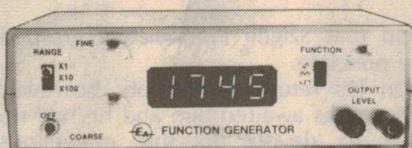
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The inventive genius

“The battle of the currents” — DC versus AC — raged throughout the 1880s. On one side was Edison, already famous, while on the other was an unknown newcomer, Nikola Tesla. Tesla’s concepts of AC power generation and distribution eventually carried the day, but not without controversy.

While Tesla worked at the Hungarian Telegraph office thoughts of alternating current never left his mind. Every spare moment was used in creating his unique mental constructs. Eventually, the toll became too much and Tesla had a breakdown. Doctors professed themselves mystified by his weird symptoms.

Tesla wrote: “I could hear the ticking of a watch with three rooms between myself and the timepiece. A fly alighting on a table in the room would cause a dull thud in my ear . . . the roaring noises from near and far often produced the effect of spoken words which would have frightened me had I not been able to resolve them into their accidental components.

“In the dark I had the sense of a bat and could detect the presence of an object 12 feet away by a creepy sensation on my forehead. My pulse varied from a few to 260 beats.”

The physicians’ cures did nothing for him, but slowly the malady ebbed. Tesla was pleased that his memory had not been affected, for his ability to quote from the classics remained as sure as ever.

One afternoon in February, 1882, whilst walking in a park with his assistant, Szigeti, he spoke some lines from Goethe:

The glow retreats, done is the day of toil;

It yonder hastens, new fields of life exploring;

Ah, that no wing can lift me from the soil;

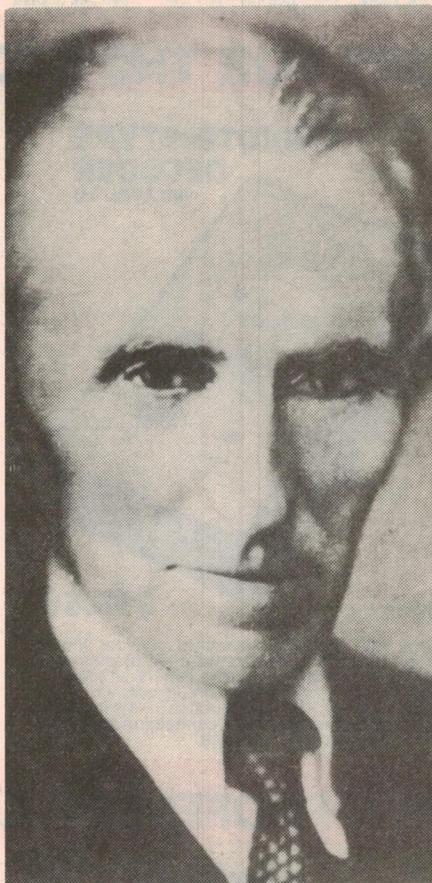
Upon its track to follow, follow soaring . . .

Suddenly he fell silent. There, before him, was the device he had thought about so long.

“Watch me reverse it,” he told Szigeti. His assistant, naturally seeing nothing, feared that Tesla had had a relapse.

Impatiently, Tesla described the concept that had flashed into his mind when he quoted those lines of poetry: a two-phase circuit — two magnetic fields — that would create a rotating force to pull a rotor by induction. Quickly, he picked up a stick and sketched the circuit in the dust of the path. His exposition was so

Photo courtesy Westinghouse Electric Corp.



One of the few photographs of Tesla, taken late in life.

lucid that Szigeti immediately grasped the principle.

On his return to his job, however, other tasks awaited him and he had no time to devote to this marvellous discovery. It did not worry him, for he could build his mental constructs and set them running, to be examined at some future date. Soon, the telephone central office was completed.

In the spring of 1882, Tesla travelled to Paris, securing employment with the Continental Edison Co. After some design work, a power plant assignment took him to Strassburg. A physical example of the rotary field AC motor was constructed there in the summer of 1883. When not wasting time with the Germanic bureaucracy, he tried to raise in-

terest and capital for his AC discovery but had no luck.

Returning to Paris early in 1884, he found the same situation. What is more, the large bonus he had been promised for earlier design work and his efforts as trouble-shooter in Strassburg never materialised. At that point, he determined to go to “The Land of Golden Promise” — America.

Armed with a letter from Charles Batchelor, a company director, and a personal friend of Thomas Edison, Tesla prepared to depart Europe, perhaps for good. On his way to the docks, someone picked his pocket. He convinced ship’s personnel that he had booked a passage by quoting the ticket number. He arrived in the United States with a book of his poems, a couple of technical articles, some notes on a mathematical problem, a design for a flying machine — and four cents in his pocket.

Nikola Tesla presented himself to Edison straight away. The famous Yankee inventor looked suspiciously at this dapper foreigner before him, but read the letter of recommendation from Batchelor:

“I know two famous men and you are one of them,” it said. “The other is this young man.”

On the strength of that, Edison offered the excellently educated and well-experienced engineer \$18 a week — hardly more than he paid one of his mechanics. Tesla, for his part, was quite impressed by Thomas Alva Edison, almost a legend in his own lifetime.

He was to write: “The meeting with Edison was a memorable event in my life. I was amazed at this wonderful man who, without early advantages and scientific training, had accomplished so much. I had studied a dozen languages, delved in literature and art . . . and felt that most of my life had been squandered.”

At first, Tesla was given very junior tasks but soon he had won Edison’s confidence. On one occasion, Tesla was despatched to the steamship Oregon, which had missed its sailing date, due to a problem with Edison generating equipment on board. At five o’clock the next

of Nikola Tesla Part 2

by J. L. ELKHORNE

morning, Tesla, with the assistance of the crew, had effected major repairs and was returning to the shop, when he met Edison and Batchellor, recently returned from Europe.

"Here is our Parisian running around at night," Edison commented. Tesla informed him that the repairs on the Oregon had just been completed. As he left, he heard Edison tell Batchellor: "This is a damn good man."

The good relationship would soon deteriorate, however. As soon as Tesla mentioned his ideas about alternating current, Edison silenced him. Then, in one of those little incidents that grow all out of proportion, Nikola Tesla would misunderstand a casual statement.

He had suggested some significant improvements to the Edison equipment. The American inventor remarked: "There's \$50,000 in it for you, if it works."

Soon, Tesla had completed his calculations and tests. His improvements were put into practice. Time passed, and the reward he envisaged did not occur.

'The American inventor remarked: "There's \$50,000 in it for you, if it works'"

Finally, he questioned Edison about it, and learned that it was "a practical joke". Tesla could not laugh, however. He had designed 24 different types of machines, in a workday which went from 10.30 in the morning to 5am the next morning — without a day's exception — for nearly a year.

Tesla resigned.

His initial impression of Edison had been tempered by observation of the great man at work: "If Edison had a needle to find in a haystack, he would proceed at once with the diligence of the bee to examine straw after straw until he found the object of his search. I was a sorry witness of such doings, knowing that a little theory and calculation would have saved him 90% of his labour."

Edison relied on his "intuition" and trial-and-error methods. After 10,000 trials for a new type of storage battery had proved fruitless, Edison bragged that he had not failed. "I now know 10,000 ways that won't work," he said.

Unfortunately, Edison had the reputation — and the money to follow his own path. Tesla, only a year in America, had no money, no contacts, and no pro-

Photo courtesy Westinghouse Electric Corp.



This tower was built on Long Island in 1904 while Tesla was experimenting with power distribution by wireless.

spects. Still, a group of entrepreneurs approached him with an idea to start yet another street lighting company, still a money-maker in the big cities. Tesla worked for some time, designing new types of arc lights and regulators, and eventually found himself the possessor of a stock certificate of doubtful value.

Edison, bitter over their differences, told anyone who would listen that the foreigner was not to be trusted. Tesla went through such hardship during the next year that he seldom spoke of it afterwards. He did occasional electrical repair jobs and during the bitter winter of '86-7, worked as a common labourer. His foreman, a stockbroker who had lost

everything in the market, maintained contacts in the business world. After listening to Nikola Tesla at length, he approached an executive, A. K. Brown, of the Western Union Telegraph Co.

Brown and an associate were favourably impressed by Tesla and financed a laboratory for the inventor, not far from the Edison works. The concepts Tesla had developed five years earlier were on file — in his head. His original motor lay forgotten in Europe; the later work had all been intellectual. By October of 1887, Tesla built his engine models. He filed for patent on an alternating current system, of which the motor was only a part.

The inventive genius of Nikola Tesla

Just as Edison had foreseen that the electric light without a distribution system was of little import, so Tesla regarded his discovery of the rotating magnetic field. To him, the motor provided only a piece of a unified system. The US Patent Office, however, reacted with horror at his sweeping approach. They broke the original application down into seven sections, and by the end of the year, had issued 30 basic patents.

As his work began to receive publicity, he was hailed as the scientific genius of the age. On invitation, he delivered a lecture before the American Institute of Electrical Engineers on May 16, 1888. The theory and practice he presented are the basis of the system we still use today. Improvements have been made, to be sure, but offer no radical departures to his central concept. In one stroke, he accomplished an engineering breakthrough of such magnitude that no comparable development has been presented since – especially by a single individual.

The group of patents included single and multi-phase motors, polyphase distribution and transformers, alternating current generators, AC to DC conversion, condensers, insulators and meters.

Five years before, Edison had electrified New York City, a remarkable achievement – with remarkable limitations. Even with his feeder-and-main distribution system, there was about a 30 volt drop overall. The nominal 110 volt adopted by Edison was compensated for by generating at 120 or even 130 volts. Those closest to the central station had brighter light – and quicker burnouts; those people at the far end had light that left much to be desired. The Edison system was predicted on an arrangement of a power house every mile or so. Although men had actually made DC generators that emitted as much as 6kV, outside the laboratory such machines were not practical, nor was long-distance transmission feasible with them. Line loss remained a significant factor of DC operation.

With Tesla's polyphase system, however, power could be generated anywhere, transformed, sent down a transmission line, and then stepped down at the point of use, all with a very high efficiency.

Fortunately for Tesla – and for mankind – a man of commerce who could bring this scientific feat out of the laboratory and to the world of everyday engineering practice made his approach.

George Westinghouse, inventor and head of his own company, had succeeded after the American Civil War in marketing a portable device for getting derailed cars back on the tracks.

His invention of the railroad air brake though, established him as one of the giants of American business. He went on to become a pioneer of the gas-distribution and lighting industry. When Edison's electric distribution system began making itself felt, Westinghouse knew he needed to get involved in electricity to remain competitive. He swiftly mastered the state-of-the-art and bought the patent rights of various inventions. He designed a transformer, after study of the recent Gaulard-Gibbs unit, in three weeks. Having invented one of the first steam turbines in the world, he was

"I will give you a million dollars for the use of your AC patents."

quick to realise that a practical AC motor would be the key to a new and profitable system.

When he heard of the Tesla patents in the latter part of 1887, he had already organised the Westinghouse Electric Company. He saw the importance of the rotating magnetic field concept. He approached Tesla in 1888 with an offer that could not be refused: "I will give you a million dollars for the use of your AC patents," he told the gaunt inventor, 10 years his junior. Tesla later admitted that such an astounding figure shocked him speechless. After a long pause, he replied, "Accepted – if you will also offer a royalty on manufacture."

At this point legend appears to take over from known fact. A popular story has it that Tesla and Westinghouse agreed on certain sum per horsepower of equipment sold; a sum which varies – apparently depending on the re-teller of the story – from one dollar to two dollars fifty. And, according to the story, it was a handshake agreement.

Whether this was ever ratified by a formal contract is not known, and no such contract has ever been found. But the story goes on to tell how the Westinghouse board, who had provided most of the money, refused to honour the agreement, and threatened to withdraw their support on the basis that it would bankrupt the company.

At this stage Tesla reputedly tore up the contract rather than see the company, and his work fail.

By all accounts, including that of Westinghouse historian Charles A. Ruch, this legend is just that; a legend arising out of a royalty discussion which was documented but which never went beyond that stage.

At any rate, the initial payment for patent rights (which one writer states was only \$200,000) was split with Tesla's backers. With a small fortune at his fingertips, Tesla found himself eager to pursue remarkable new areas on the frontier of science. Westinghouse, however, convinced him that immediate practical work on the problem at hand was necessary.

Edison, extremely worried over his two million dollar investment in the New York City generating system, launched a vitriolic attack on the new system. With his usual publicity machine in action, he raised the horrors of imminent electrocution of the general public exposed to the AC system.

He wrote: "Just as certain as death Westinghouse will kill a customer within six months after he puts in a system of any size. He has got a new thing and it will require a great deal of experimenting to get it working practically. It will never be free from danger."

Edison men distributed pamphlets, warning the populace that it would be a matter of taking one's life in his hands to merely walk the streets, constantly at the mercy of the lethal high-tension wires. The fact that a lineman a month on the Edison system was killed was ignored. Convinced by their boss's propaganda the DC was inherently safe, they failed to take adequate safety precautions.

Half a mile from his estate at West Orange, New Jersey, Edison had built a large laboratory, replacing the facilities at Menlo Park. As part of his propaganda campaign, he and his associates regularly electrocuted "stray" cats and dogs in public demonstrations.

Animals were purchased at 25 cents a head from local schoolboys. Immediately after their acquisition, they were thrown onto a contrivance powered by a 1kV alternator, possibly manufactured by the Westinghouse Electric Company. The pet population of the New Jersey community was nearly wiped out.

Charles Batchellor, who had unleashed Tesla on Edison and America, suffered an unfortunate experience while helping his boss in these enlightenments. One large dog, having deduced no good was about to be done him, wriggled out of Batchellor's grasp, knocking the man

In one stroke, he accomplished an engineering breakthrough of such

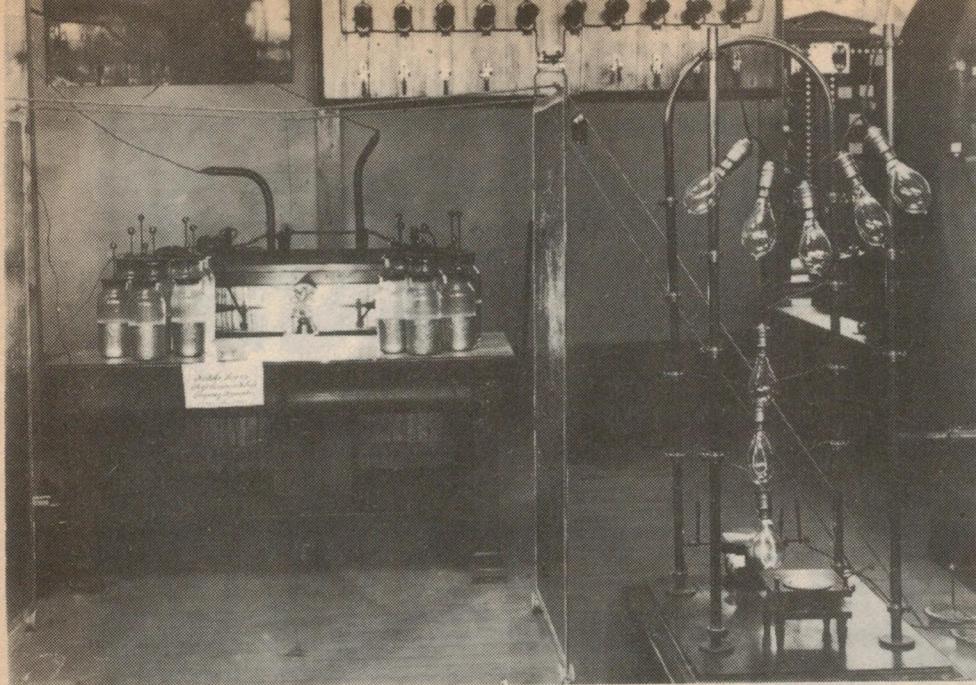


Photo courtesy Westinghouse Electric Corp.

he proceeded to research apparatus working on higher and higher frequencies. He built an alternator with 384 poles which generated 10,000 Hertz. Although he finally achieved a stable rotary machine working at 30,000 Hertz, he abandoned such equipment for new apparatus capable of far higher frequencies. At the same time, he delved into the areas of mechanics, pneumatics, hydraulics and resonance phenomena.

His first high-frequency experiments culminated in a lecture at Columbia College on May 20, 1891. In it, he demonstrated the high-frequency alternator, as a power source for induction coils of his own design. He showed many curious electrostatic effects, so-called bush discharges, unique forms of incandescent lamps, and the first demonstration of wireless lighting. He achieved the phenomenon of stationary waves in a large copper bar, lighting various types of lamps at the maximum potential nodes of what seemed in conventional terms to be a short-circuit.

From the mundane world of low-frequency alternations, he had leaped into a strange, new frontier where each discovery was more unbelievable than the last – except for the fact that he was able to show experimental proofs to an astounded audience.

These investigations were the predecessor to the development of the Tesla coil. At this time, he was working with closely-coupled coils, sometimes cored, and immersed in oil or insulated with paraffin to prevent arc-over.

One of the more curious effects he demonstrated was the illumination of a carbon filament lamp, in which the globe itself was incandescent, whilst the filament remained dark! He also developed a lamp with a single button of ruby which emitted light.

His unique research so fired the imagination of scientific men that he was invited to England. In February, 1892, he gave a more advanced lecture before the Institution of Electrical Engineers, London, titled "Experiments with Alternate Currents of High Potential and High Frequency." Work he had done the previous year had been added to considerably. He had worked with Crookes tubes, precursors of the cathode ray tube. As the electron was not yet known to scientists, a great many puzzles manifested themselves in this research. Tesla was still working with relatively small, oil-insulated coils, but had made considerable advances in the types of sparkgaps employed. Dozens of fantastic luminescent effects were displayed: A group of incandescent lamps that had solid buttons of various materials instead

Continued on page 134

A high voltage, high frequency set-up at Tesla's Westinghouse Laboratory.

himself onto the electrocution platform. Although he was not killed, he described the sensation: "(as) the sensation of an immense rough file thrust through the quivering fibres of the body."

Edison published an article defending his cruelty to animals, saying: "I have taken life – not human life – in the belief that the end justifies the means."

H. P. Brown, who had been a laboratory assistant at West Orange, himself began public execution of cats and dogs. He claimed to be demonstrating that such a death was "instantaneous, painless and humane." He became a lobbyist and independent consultant to the New York State legislature, helping to usher in a bill allowing capital punishment by electrocution. As soon as the statute became law, he made a well-publicised purchase of Westinghouse equipment, which was installed at Sing Sing Prison.

Westinghouse appealed to common sense, issuing a public statement that no deaths by electrocution had previously been caused by his company's equipment. He managed to counter a suggestion that the term "to Westinghouse" be used to refer to electrocution of condemned criminals.

Over strenuous objections by Westinghouse and his associates, the authorities finally decided to give the new statute – and equipment – a test. On the night of August 6, 1890, convicted wife murderer, William Kemmler, was led from his cell. Moments later, he found himself vibrating to a jolt of Westinghouse alternating current. To the chagrin of the prison officials, the shock did not kill him – the voltage was too low. He was unstrapped from the chair, marched back to his cell, and the

electric chair examined. A wiring fault was found. (The electrician was probably another Edison man – fearful of his proximity to such a devilish machine.)

Hasty modifications were effected – and William Kemmler brought once again to face his punishment. This time, death was instantaneous, but called by one observer "an awful spectacle, far worse than hanging." Apparently, the optimum high-tension had been far exceeded . . .

Tesla found himself fighting Westinghouse engineers in Pittsburgh during the year 1889. He had selected 60 Hertz as the best compromise frequency for commercial power applications. Westinghouse engineers (or company accountants) had decided that 133 cycles a second would be the standard –

"He built an alternator with 384 poles which generated 10,000 Hertz."

it would decrease the cost of core materials. Even though George Westinghouse offered Tesla a \$24,000 per annum salary to stay, the younger man argued he wasted his time in minor design work, disagreements, and was not free for creative work.

"At the close of 1889, my services in Pittsburgh being no longer essential, I returned to New York and resumed experimental work in a laboratory on Grand St." Tesla later wrote.

Back in New York City, he began spending lavishly. He embarked on a program of research into a number of areas simultaneously. Familiar with the work of James Clark Maxwell and Heinrich Hertz,

magnitude that no comparable development has been presented since –

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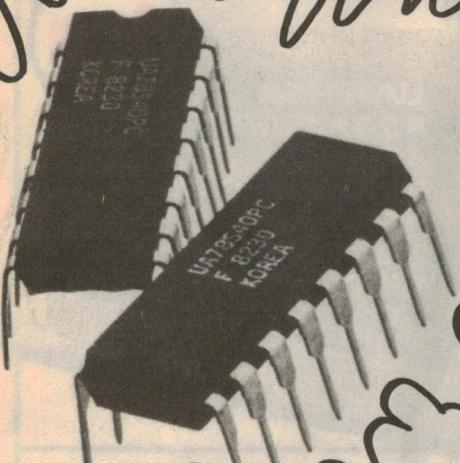
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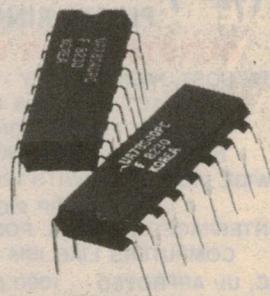
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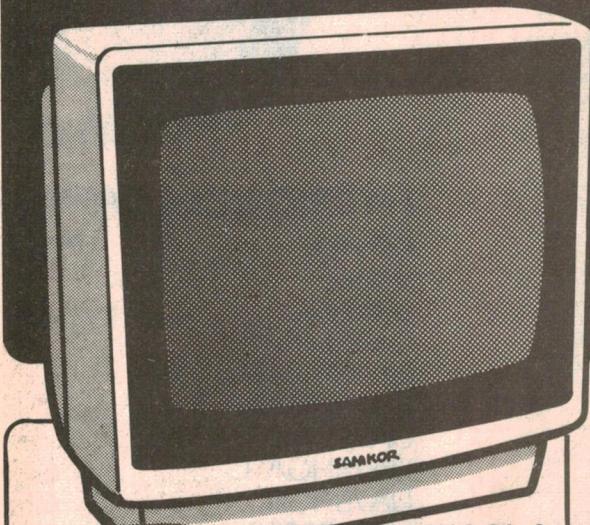
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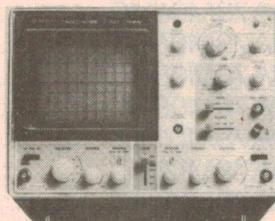
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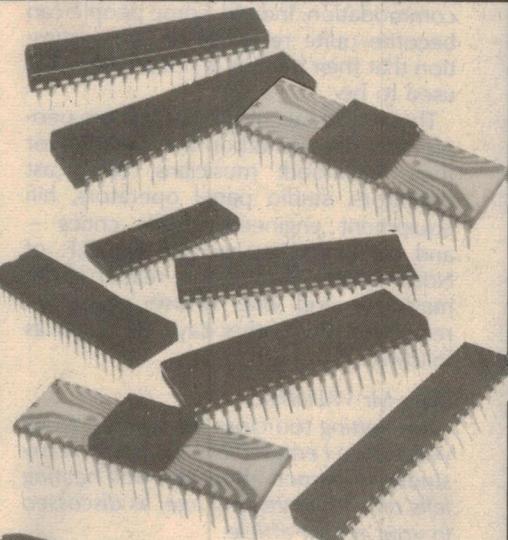
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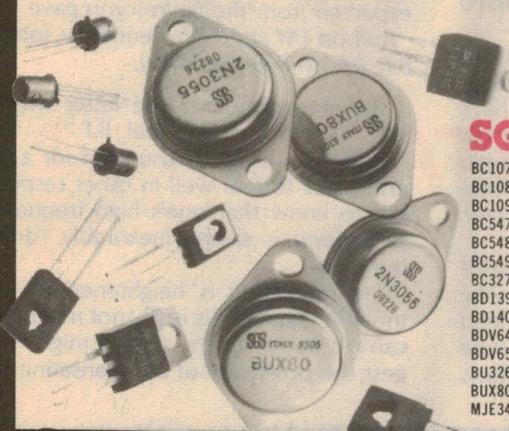
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Are ageing ears really as sluggish

An article in the June issue — "Hifi Sound But Lofi Ears" — seemed to create considerable interest, being taken up, I understand, by groups catering for the hard of hearing. But it also raised again the old question: are ageing ears really as limited as the literature says?

In so phrasing the above introduction, I may appear to be drawing a distinction between theory and practice — an old source of contention referred to again in the last instalment of "Forum". But I'm not being inconsistent; some of the theory to do with aural perception is rather tentative, while a lot more remains to be done on the practical side as well.

But let's not get sidetracked.

On page 45 of the June issue, we published a table suggesting that, with "clinically normal" ears, the upper limit of hearing diminishes from about 18,000Hz at age 10, to about 4000Hz at age 80 — a loss of about 2000Hz for each additional 10 years in age.

On page 46, we showed a set of curves indicating the progressive loss in aural acuity for frequencies below the upper limit. It was apparent from the curves that the gradual loss in treble response is roughly equivalent to turning the treble control progressively back to full cut — a situation reached by people in the 50-60 year age group.

HISS LESS NOTICEABLE

A further set of curves on the same page showed how progressive high frequency hearing loss can diminish awareness of tape hiss, particularly for people in the over-50 age bracket.

While such curves must be regarded as an approximation only, they are at least "in the ballpark" and they are in accordance with everyday observations:

Adults do show a measurable, progressive loss in aural acuity, especially at the higher frequencies. Top-cut filters and tone controls do seem to be less drastic in their effect than once they were. Octagonarians do complain that people no longer speak distinctly — because they can no longer hear the sibilants and the explosive sounds.

With the passing years, tape hiss does seem to be less of a problem than once it was, with noise reduction systems appearing to be more of a fad than necessity!

For most people, the loss of aural acuity is very gradual, being rendered the

more so by a degree of unconscious accommodation. Indeed, some people can become quite resentful of any suggestion that their hearing is not as keen as it used to be.

Those who take it the hardest are people who have relied on their hearing for their livelihood: musicians, broadcast operators, studio panel operators, hifi equipment engineers, music critics — and hifi journalists; people like B.F. of North Sydney, a long-time reader of the magazine and one whose name we remember from other days. He writes as follows:

Dear Mr Williams,

It is getting too close for comfort to 40 years since I entered broadcasting. In my studies, I learned about the way hearing falls off with increasing age, as discussed in your recent article.

But, somehow, the old technicians seemed to have an ability to hear things, despite what the textbooks said. I have often wondered if people's hearing did not deteriorate as much as the books said — provided they had really been using the faculty of hearing high frequencies.

Faculties not used do tend to waste away and, in the pre-hifi days, why would people in western society need high frequency hearing? To those people who rubbish the advance in technology,

Referenced to clinically normal hearing of 20-year-old females (0dB), these curves give some idea of the gradual loss of aural acuity with increasing age. The dotted curve shows the response of a typical hifi amplifier system with the treble tone control set for maximum cut.

FORUM

Conducted by Neville Williams

the very availability of hifi equipment of a standard undreamed of when I began broadcasting, may have the effect of sustaining high frequency hearing.

Unfortunately, researching this would not be the sort of exercise that an academic could get into and out of quickly, with a research paper under his arm to help him in his upward climb. It would be a very long project to measure the hearing of broadcast technicians, when they first entered a station, then monitoring their hearing for the next 45 years, until retirement.

In my own case, one ear is markedly inferior to the other but, while it is 20 years since I left broadcasting and while I am getting too close to 60 for my liking, I still think my good ear has retained better high frequency hearing than I could have expected from the figures you gave.

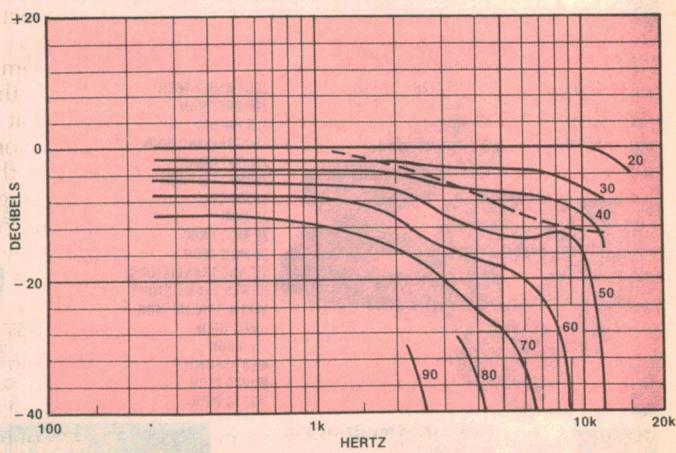
Roll on FM and high frequency sound! B.F. (North Sydney, NSW).

My first reaction to the letter was to say: "I know how you feel, B.F."

There is a certain frustration for a hifi enthusiast to feel well in other respects but to know that one's high frequency perception is sliding inexorably "down the drain".

The frustration is heightened by the thought that there is really not much one can do about it. The curves might suggest the possibility of compensating the

FREQUENCY RESPONSE V. AGE



as the books say?

droop by advancing the treble control – but only providing the amplifier and tweeters can handle the higher output and the family can put up with the sssibilant sssound!

And even then, no practical amount of treble boost can compensate for the usual "brick wall" roll off at the top end. If the hearing rolls off at six or eight or 10kHz, then that's it, treble boost or no treble boost!

Nor do I know of anything to support B.F.'s fond hope that high frequency acuity has been – or will be – preserved by "exercise", as provided by wide-range hi-fi equipment. After all, there are plenty of age-old natural sounds which have an aurally delicious high frequency content, but they haven't kept us aurally fit.

VOICES FROM THE PAST

In acknowledging B.F.'s letter privately, I could only concede that: "technicians may develop a certain skill in using the aural faculty that remains, but not of actually hearing what, to them, is inaudible". Reading it again, I must admit that it sounds like a fairly lame statement.

There the matter might have remained had I not, quite by accident, come across an item in the October 1951 issue, while looking up references for last month's: "Let's Buy An Argument – Where It all Started". It was a letter written by "Diallist" of "Wireless World" fame, which we reprinted under the heading "To Hear Or Not To Hear". . .

It seems that Sir Ernest Fisk, at that time Chairman of EMI Britain, had just announced to the Royal Society of Arts that his Company had been successful in recording frequencies on wax disc of up to 20,000 c/s. (Hz came much later). Diallist's first reaction was to suggest that "aged dodderers" like himself, who normally have a cut-off in the neighbourhood of 10,000-12,000 c/s, might well retort: "So what".

Somewhat abbreviated, his letter continues:

But when Sir Malcolm Sargent and others maintain that even higher frequencies may have to be recorded in order to obtain complete realism in reproduction, you begin to do some thinking.

At first blast, the idea seems utter nonsense. How can we be affected by the presence or absence of frequencies that we can't hear? And then something at the back of your mind whispers: $f_1 - f_2 = f_3$ in other words: two supersonic frequencies may produce an audible beat frequency.

It seems possible that, when an or-

chestra is in action, the supersonic harmonics of certain instruments do produce such beats. If they are absent from an electro-mechanical reproduction, it doesn't sound quite real.

If the original supersonic harmonics are, say, 19,000 and 21,000 c/s, the beat will be at the audible frequency of 2000 c/s. Assuming that there is such a beat and that I record and reproduce up to, perhaps, 6000 c/s, why should not the beat frequency of 2000 c/s be adequately brought out, even though the generating frequencies are removed by the cut-off at 6000 c/s?

The answer is that non-linearity is required somewhere in the system to produce the beats. If the recording system is totally free from non-linear distortion, the beats will not be generated as such in the record, nor will they be present in the reproducing equipment if it is similarly distortion-free.

Not until the original supersonic frequencies reach that non-linear device known as the human ear will the audible beat frequency emerge.

So, if you want to cut off at 16 kc/s in recording, you must do your mixing before that and introduce some non-linearity before or in the cutter head, if you want to generate and record those beats. Which poses the question: if one records only audible frequencies, how much non-linear distortion should be introduced for realistic reproduction? ("Diallist").

MUSICAL BEATS . . .

Perhaps I should explain that, a couple of months prior to the publication of Diallist's letter, there had been spirited debate in the "Let's Buy an Argument" columns on the subject of musical beats – the effect that musicians make use of to help tune musical instruments. There seemed to be fairly common agreement, at the time, that our awareness of beats was a by-product of basic non-linearity in the human ear.

The letter from "Diallist" added a new dimension to this discussion. On the assumption that the ear could indeed behave as a non-linear mixer, he was suggesting that the intermodulation products would range far beyond the slow, pulsating beats observed by instrument tuners; that they would cover a whole range of audible frequencies and be produced even by the intermodulation of overtones in the supersonic range.

(For this argument to hold good, frequencies outside a person's audible range would still have to be processed by some part of their hearing mechanism

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FORUM — continued

— eg the outer and middle ear — to produce the beats which could penetrate the otherwise unresponsive inner ear. Whether or not it could happen this way, I leave to others to decide.

The argument advanced by Diallist was clear enough, however: when listening to a live musical performance, the subjective listening experience is not confined to frequencies which are generated and heard directly, but include a whole spectrum of intermodulation products.

How the brain might interpret these modulation products is a fertile area for speculation:

- Optimistically, the brain might learn to perform a kind of "instant Fourier analysis" and add further overtones to the frequencies which the ears are processing directly.

- Pessimistically, and especially in the presence of high aural non-linearity, the brain may not be able to cope with the modulation products and may register a strong dislike of complex musical sound. There are any number of people who do react in this manner and it could be for this very reason.

BACK TO B.F.'s LETTER

Curiously, this kind of thinking, extrapolated from what Diallist penned in 1951, brings us back to the letter from B.F., mentioned earlier. B.F. is searching for a reason why older broadcast station operators (allegedly) seem to be able to sense more about sound quality than would seem likely from their aural response, as measured with a single, variable tone audiometer.

Superficially, I can advance no reason why broadcast operators and their ilk should have any more extended hearing than the statistics suggest. Indeed, they might even end up below average if they have been indiscreet in the matter of listening levels! But could it be — just could it be — that they have learned to make better than average use of the intermodulation products which are still within their range of hearing?

Diallist — in 1951 anyway — seemed to support that possibility.

It's a very tenuous proposition, B.F., and I'm not suggesting that it could be a substitute for the athletic hearing of youth, but it may just be a small compensation; a reason why a musically educated brain may develop what I suggested earlier: "a certain skill in using the aural faculty that remains."

Of one thing you can be certain B.F. There are plenty of people who would share your fervent hopes that there is more to hearing than a straight-out single-tone audiometer test; people who would welcome even a temporary "stay

of execution" in the auditory sense!

But let's think again about Diallist's letter:

When he wrote as he did in 1951, he was speculating both about intermodulation effects in human hearing and the role of non-linearity distortion in sound recording and reproduction systems. If it was not possible to cope with the entire energy spectrum of music, he wondered, might it not be wise to design a specific amount of non-linearity into the system to create and retain intermodulation products of the magnitude that the listener's brain expects?

When I re-read this letter, a couple of weeks ago, it reminded me of a test record issued some time back by Ortofon; in fact two similar test records: a direct-cut version 0001 and a tape-mastered version 0002.

One group of tracks on the first side carries pairs of high frequencies, spaced 1kHz apart, which are intended primarily to provide a measure of the intermodulation distortion percentage in a disc replay system.

The first such track contains frequencies of 20kHz and 19kHz. Both are well above the range of normal hearing but, when the track is played, a 1kHz difference tone can be heard, not loudly but quite distinctly. Following tracks provide frequency pairs at 18/17kHz, 16/15kHz, 14/13kHz, etc, some of which will also lie beyond the hearing range of many mature adults.

For the purpose of identification, the high frequency signal pairs are coded into repetitive long and short dashes, forming the Morse code letter "N". A pure 1kHz reference tone occupies the intervening spaces, thereby forming the Morse code letter "A". If the difference tone (letter N) is less loud than the reference tone (letter A) it is an indication that the intermodulation distortion through the entire system, as heard, is less than 2%.

First Aussie valve?

"Wireless Weekly" for Sept. 29, 1933 carried a picture of a rather modern looking "80" type rectifier with a caption to the effect that it was the first valve to be manufactured in Australia. It may have been the first valve from the then newly constituted Amalgamated Wireless Valve Company but, in his book "70 Years of Radio Tubes and Valves", New Zealand Author John Stokes states that valve manufacture had been undertaken in Australia by AWA "as early as 1920", an early example being the AWA "Expanse B" valve.

In the relevant explanatory notes, Ortofon observes that, if the reference tone "A" is the louder, the system is All right. If the difference tone "N" is the louder, then that is Not good!

In my own system, the test indicated that the intermodulation distortion was a lot less than 2% — ostensibly a desirable result. But, even so, the difference product from the two test tones was clearly audible suggesting that, even with a direct cut analog disc and good quality everything else, spurious intermodulation products are present.

How much worse they must have been in 1951!

I took the opportunity to repeat the tests with the treble control and filter both set for minimum response, thereby virtually eliminating the high frequency source tones from the power amplifier and loudspeakers. It made virtually no difference to the N/A ratio, indicating that the 1kHz difference tone had already been generated in the record/replay system and prior to the tone control stage; the contribution from the output system and from my ears seemed to be negligibly small.

Perhaps, if Diallist had been able to make similar observations in 1951, he might have reached a different conclusion.

NON-LINEARITY . . . NO!

Having just been through the exercise, however, I cannot escape the conviction that non-linearity distortion is a liability at any level, and I doubt very much its ability to compensate for frequencies which fall outside the passband of either equipment or ears.

Sorry Diallist and sorry B.F. for having dangled a carrot, earlier in the article, only to whip it away at the end!

In offering the foregoing opinion, I had better be right because, if I'm wrong, the world audio industry will share the egg on my face.

In recent years, the entire hifi industry has embraced sampling and digital techniques, ranging from FM-stereo multiplex to digital tapes and discs. All of these systems involve a sharp roll-off filter operating just above the audible frequency range — by implication rejecting the musical significance of possible supersonic overtones.

Not only that, but systems like the compact disc and VCR-based digital tape recording have further transgressed Diallist's proposition by virtually eliminating distortion and the consequent generation within the system of spurious difference tones.

Nothing personal . . . but one can only hope that Diallist was wrong on this particular occasion.



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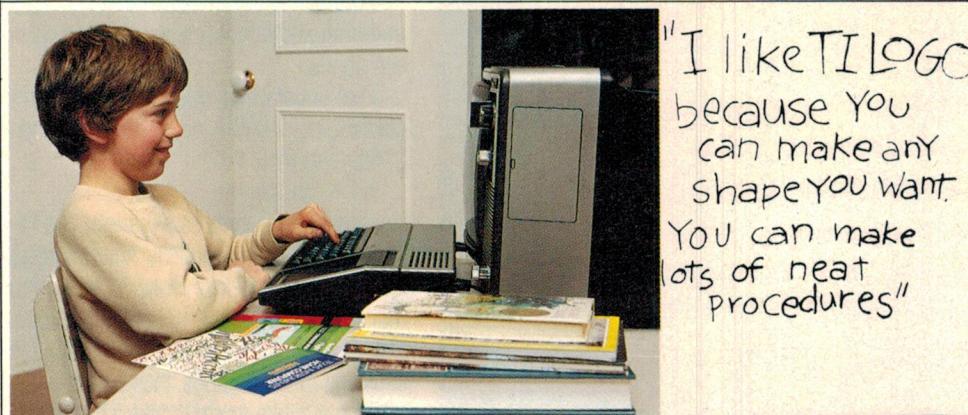
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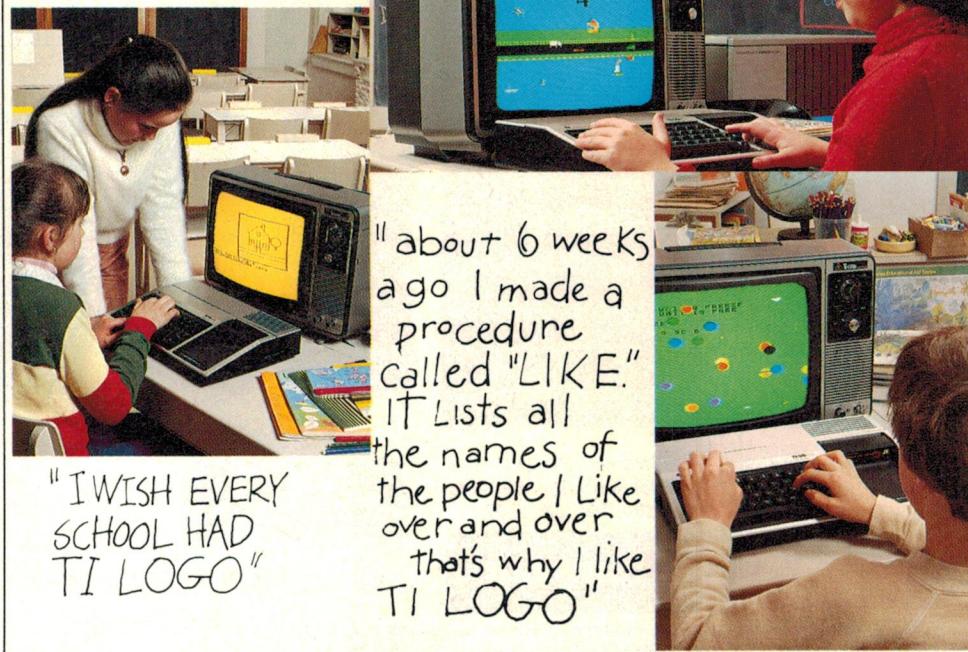
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TEXAS INSTRUMENTS

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Audio-video Electronics

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25yr old "Wondergram" becomes the new "Sound Burger"

Twenty-five years ago, a two-speed personal portable record player was announced for pending world release by a British company. It failed to make its mark but, just recently, Audio-Technica of Japan have released an essentially similar unit, styled for the headphone-stereo generation.

The original "Wondergram" was announced and pictured in our September 1958 issue. It was to be manufactured by Camp Bird Industries of London, under the chairmanship of Major C. Collaro — at that time a very well known name in the British audio industry. The company was reported to have set up two fully automated production lines and to be aiming for volume sales in the USA at about \$20 per unit.

Seeking to match the impressive economies that had become possible with solid-state amplifiers, Major Collaro and his team had produced a small six-volt governor-controlled motor and a two-speed disc drive system that involved very few moving parts. It could be powered from the same battery as the amplifier, with the output fed to a small loudspeaker in the lid section of the case.

When folded for carrying, the Wondergram measured



The "Sound Burger" close up and, below, in a New Zealand setting

about 8 x 4 x 1 inch (200 x 100 x 25mm). While it could play discs up to 300mm in diameter, it had no provision for a turntable, as such. In use, the unit was placed flat on a table; raising the hinged lid section exposed a rubber coated spindle and drive fingers, over which the disc was placed. When the lid was closed again, a free-wheeling nipple on the underside locked the disc against the drive, keeping it mechanically stable.

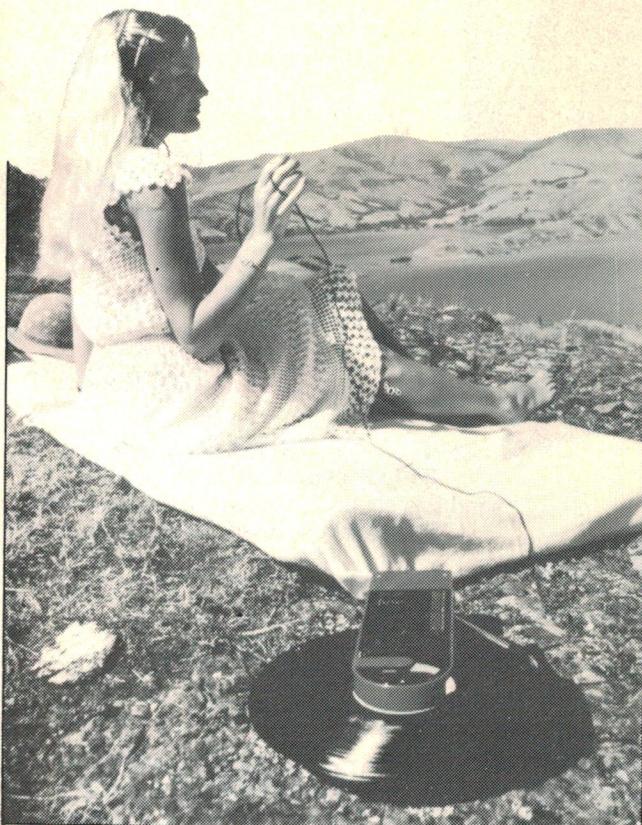
The tone arm, which at first glance looked like part of the lid, could then be swung out and placed on the playing surface.

Reportedly, the company had a mains powered unit under development which was intended primarily for connection to an existing radio receiver or amplifier. It was hoped at the time that the actual factory cost of the mains unit could be kept down to little more than £1 (\$2) per unit. Presumably, however, neither the mains nor the battery unit lived up to market expectations.

The new model AT727 "Sound Burger" from Audio-Technica (pictured) is very similar, at first glance, to the original "Wondergram". It is the same general shape and size, weighs about 1.2kg and also comes with a shoulder strap for ease of carrying. It opens up in the same way to receive the disc, and the pickup arm pulls out from the side of the lid. But there the similarity ends, with the Sound Burger having the benefit of new technology and new consumer expectations.

It has been designed, primarily, to take advantage of the comparatively recent swing to personal stereo listening, using miniature hifi-stereo headphones. The Sound Burger has no in-built mini-speaker to limit quality and chew up battery power; it comes with mini hifi headphones, which fold up, for carrying, like a pair of spectacles. It provides a more modern disc drive system and a good quality magnetic stereo cartridge to take full advantage of the quality of modern discs.

Audio-Technica admit that the Sound Burger cannot be played on the move, like a personal cassette player but, against this, it gives direct access to the wealth of sound currently available on disc. It is cushioned to minimise



vibration from the surface on which it may be placed while the tonearm is dynamically balanced to obviate problems with non-level surfaces. Output connections are provided for two sets of stereo headphones and for connection to an external audio system for dubbing or loudspeakers listening.

The Sound Burger is intended for world release and, according to a New Zealand reader, Mr Dolf de Roos, has been announced for release in that country at \$NZ289. As yet, we are not aware of release arrangements for Australia.

Australian venture... UHQR "UP MARKET" AUDIO CASSETTES

Like David, but taking on a whole array of Goliaths, a small Australian company is seeking to break into the market for prestige quality audio cassettes, using the somewhat familiar initials UHQR.

A division of Mofid Records Pty Ltd, the new company has registered the name "UHQR Sound Laboratories" in Australia and is operating from the same address: 421 Forest Rd, Bexley, NSW 2207. Phone (02) 59 4727.



Mofid Records Pty Ltd is already well established in the specialist audiophile market handling, among other products, discs and cassettes issued by Mobile Fidelity Sound Laboratories in the USA, some of which carry the endorsement UHQR; hence the familiar initials.

Some time ago, facing the uncertainty of being created by the emergence of compact disc, Mofid Records proprietor/manager Bob Hessing, decided to diversify into the local manufacture of compact cassettes. However, being so deeply involved in audiophile products, he seems to have little choice but to set his sights on the quality market rather than the budget end.

As a starting point, he decided to concentrate on the cassette shell, on the reasoning that, no matter how good the tape and formulation may be, its desirable qualities can all too easily be negated by lack of precision in the mechanics or by heat warp, both of which can produce tape wander, azimuth error and unpredictable contact between coating and head gaps.



POLAROID VIDEO CASSETTES

Diversifying from their essentially photographic image, Polaroid have recently announced their entry into the home video market, with a line of "Supercolour" blank video cassettes in the VHS and Beta formats. In each case, Polaroid claim performance standards equal to, or better than, system specifications.

In announcing the new marketing venture, Polaroid's General Manager for Australia, Peter Terry, pointed out that his Company was no stranger to electronics. Many of the electronic features in the Polaroid instant cameras were invented within the Company as, for example, transistorised shutters, sonar focussing and light mixing. They had made vital contributions, too, in general science, medicine, industry and business, and in hard copy imaging systems. A move into video tape was a natural extension of such activities... as it were, into instant photography of a different kind!

According to Peter Terry, Polaroid Video cassettes are manufactured to specifications laid down by Polaroid, using a high density coating of cobalt-doped ferric oxide particles. They are available in two grades - standard and super-quality - and in two popular lengths for the respective formats:

VHS E120 (120 min, 173m) STD and SHG.

VHS E180 (180 min, 258m) STD and SHG.

Beta L500 (130 min, 150m) STD and HG.

Beta L750 (195 min, 222m) STD and HG.

In a specification sheet accompanying the product release announcement, Polaroid quote the thickness of the VHS tape as 20 μ m and the width at 12.65mm with a fluctuation not exceeding 5 μ m. Video characteristics of the STD tape are said to be in exact accordance with the system reference standard, with a notably low dropout count. For the SHG tape, a still lower dropout count is claimed, with the RF output at 4MHz up by 3dB, a marginal increase in chroma output and video and colour S/N ratio up by more than 3.5dB. Polaroid also claim an ability for the tape to withstand still frame playback for more than 60 minutes. For both grades, the coating colour is black.

In the case of the Beta cassettes, the L500 uses tape 20 μ m thick, with a black coating, while the L750 is thinner, at 15 μ m, with a dark grey coating. The STD tape conforms closely with system standards but, again, the HG offers 2.1dB extra output at 4MHz, slightly higher chroma output, and S/N ratio improved by 2.1dB and 3.2dB respectively for video and colour. The dropout figures are the same as for VHS, as also is the still frame rating.

Polaroid say that their Supercolour video cassettes should be available by the time you read this, through selected outlets, including photographic retailers and video specialty stores.

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Audio-Video Electronics — continued

Reminiscent of the Japanese love for initials, UHQR (Ultra High Quality Recording) Laboratories have come up with what they describe as the ULM (Ultra Laboratory Mechanism) cassette shell that is manufactured in Australia to very fine tolerances. It is moulded from a polycarbonate material with an intrinsic "memory" that ensures its return to original shape, even if subjected to otherwise unacceptable heat stresses.

Other features listed in the brochure include: a single-sided silicon slip sheet, with carbon stripes to control friction and dispel static charges; precision, polished brass guide rollers; precision designed, larger-than-normal pressure pad.

The first of the new cassettes being offered by UHQR Laboratories is branded C-100 and provides 50 + 50 minutes of playing time, giving a 10-minute bonus over the usual C-90 cassette. This is achieved without any sacrifice in tape thickness.

The tape itself, according to Bob Hessing, is an imported premium quality cobalt-doped product, intended to operate in the CrO₂ setting of cassette decks. Ratings show an MOL of +5.6dB at 333Hz, an output uniformity at 8kHz of ± 0.2 dB, a print-through factor of 60dB, and an output at 10kHz that is 1dB above the IEC-II reference tape.

UHQR C-100 compact cassettes are being distributed through specialist hi-fi stores but, if not available in your area, enquiries may be directed to UHQR Sound Laboratories at the address (or phone number) given earlier.

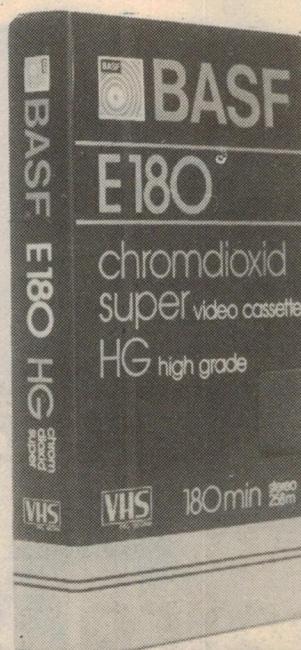
By way of a special introductory offer, UHQR have a gold-stamped velvet-covered "UHQR Cassette Library" case, which is available free with a six-pack of UHQR cassettes.

SUPER QUALITY VIDEO CASSETTES FROM BASF

What is claimed to be a state-of-the-art video cassette has just been released by BASF. Building on long experience with chromium dioxide technology, the company claims to have produced particles which are even smaller and more uniform than previously, resulting in a smooth, even coating with outstanding high frequency resolution. For the viewer, this means the very best detail, contrast and colour, of which his/her VCR is capable. The initial release of BASF Chromdioxid Super HG cassette will be VHS E-180, Beta L-500 and VHS-C 30-minute. [BASF Australia Ltd, 55 Flemington Rd, North Melbourne 3051; phone (03) 320 6555].



Above: the SKM4031 FM mic/transmitter and below: the MVF30 microphone system.



NEW MICROPHONES FROM SENNHEISER

At the recent Trade Music Show in Sydney, R. H. Cunningham Pty Ltd engaged well known Melbourne vocalist, Nadine Wells, to demonstrate a new Sennheiser range of VHF and UHF wireless microphone systems.

Nadine Wells is pictured, left, with the new SKM4031 integrated transmitter/microphone, a unit — according to an R. H. Cunningham news release — "modelled on the now famous Profi Power Microphone". The SKM 4031 has a very high modulation range, with built-in Hi-Dyn noise suppression system and "insensitive to pop and handling noises." Sennheiser claim that the new model "compares favourably" with cabled microphones and is a notable advance in a technology which has, to date, been reserved mainly for speech amplification.

In technical terms, the SK4031 is described as an "electrostatic pressure gradient receiver", with a supercardioid response pattern and a frequency range of 70Hz-20kHz. It has an RF output of 50mW at a selected frequency between 200 and 900MHz and offers a S/N ratio of 78dB. It uses 3x1.5V alkaline-manganese AAA batteries, giving an operating time of 5 hours. All-up weight is 260gm.

Speaking at the release function, Managing Director, James Cunningham said: "a special feature of this microphone is the high sound pressure levels it will handle . . . up to 150dB without distortion".

A new miniature pocket transmitter, model SK2012, has also been released by Sennheiser, featuring very light construction, a high modulation range and the Hi-Dyn noise suppression system. The SK2012 is particularly well suited for film and TV production, especially when used in conjunction with the new sub-miniature microphone MKE2.

The pocket transmitter measures 92 x 52 x 17mm and weighs 180gm, with batteries, making it easy to conceal in the performer's clothing.

To complement the new wireless microphone systems, two new wireless microphone receivers have been introduced by Sennheiser. Where portability is a paramount consideration, the single-channel EM10019 receiver is recommended, combining compactness with a performance level which is equal to the demands of high quality

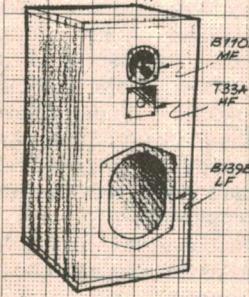


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Audio-video Electronics — cont.

microphones. It has its own telescopic antenna, features Hi-Dyn noise suppression and has provision for headphone monitoring.

The alternative EM1036 is a multi-channel Mikroport receiver, designed to meet the highest demands of professional audio production. It can be used either for individual channel operation or diversity reception, with suitable antenna units. Each channel is equipped for Hi-Dyn noise suppression.

As distinct from the wireless microphones, Sennheiser have also released a new packaged microphone system, intended primarily to meet the needs of professional and semi-professional video producers.

Called the MVF30, the basic system comes in a neat shoulder-type carrybag, which contains the powering

grip (or base) K30AV, a mini gun microphone head ME80, a windscreens for outdoor use MZW415, camera and mounting bracket MZQ30, and cable for direct connection to the camera MZK802.

Provision is made for possible expansion of the kit to include cardioid, omnidirectional and lapel microphone heads. Fully optioned, the system can provide in one package the optimum microphone for all likely on-location situations, along with a high quality signal. The standard kit has a professional-consumer price of \$295 plus tax.

Details of Sennheiser products are available from R. H. Cunningham Pty Ltd, 146 Roden St, West Melbourne, 3003; phone (03) 329 9633. In Sydney: 4-8 Waters Rd, Neutral Bay, 2089; phone (02) 909 2388.

In brief . . .

AKG ACOUSTICS, makers of AKG microphones, have turned the clock back in terms of technology although, as some would see it, not in terms of sound quality. They have produced what they call the "AKG Tube", a pressure gradient microphone with double diaphragm and — wait for it — an in-built vacuum tube preamplifier!

While the valve amplifier approach cannot rival a solid state preamplifier in terms of economy or convenience, AKG have obviously reacted to the opinion of some producers and performers that valve technology confers a "personal" quality that is not possessed by transistors.

Certainly, AKG have spared no pains in the design of the new AKG Tube. The type 6072 preamplifier valve is shock mounted inside the body of the microphone, while an elastic suspension system mounts the microphone to the stand. The microphone, suspension unit, foam windscreens and power/control unit are all contained for transport in a special flight case, along with a 10m connecting cable.

The power/control unit provides an on-off switch, plus a two-position bass roll-off control and remote control of the polar pattern: omni, cardioid, figure-of-8 and 6 intermediate patterns, adding up to 9 in all.

Details of the new microphone can be obtained through AWA.

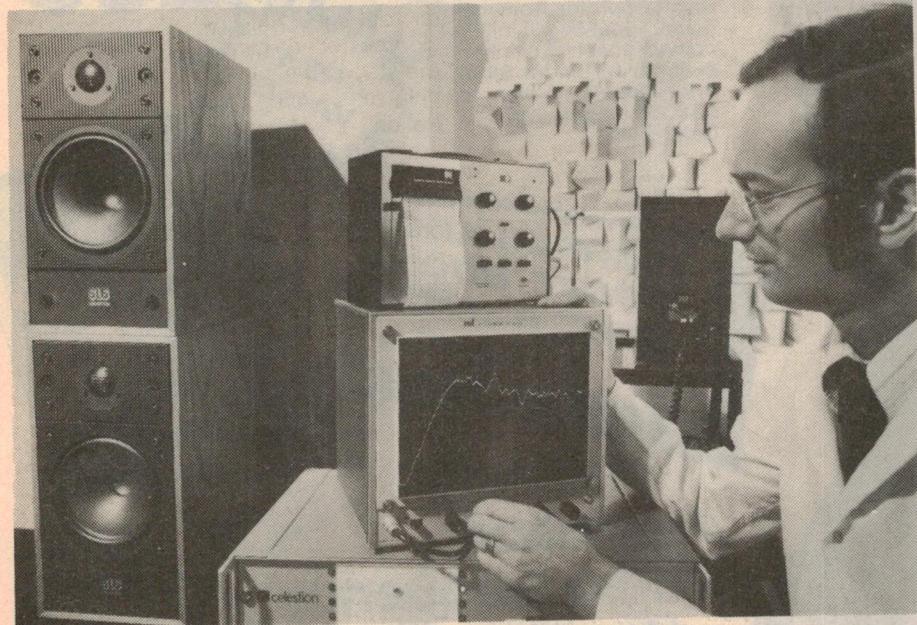
Mordaunt Short loudspeakers

A well known product on the British hifi scene, Mordaunt Short loudspeakers are handled in Australia by Concept Audio Pty Ltd of 17/89 Old Pittwater Rd, Brookvale, NSW. The new "Carnival", "Festival" and "Pageant" Series 3 range from \$525 to \$948, while other models retail for \$398 and \$1998.



NEW HIFI COMPONENTS FROM UK.

Nicknamed "The Rock", this Elite Cranfield player is the latest hifi product from Elite Townshend, of Enterprise House, 44-46 Terrace Rd, Walton-on-Thames, Surry, KT12 2SD, England. The product of a 7-year research program at the Cranfield Institute of Technology, under Senior Lecturer Jack Dinsdale, it uses a plinth and turntable of synthetic granite, claimed to be as inflexible as cast iron but 10 times less susceptible to vibration.



Released in early 1982, after 3 years of research, the Celestion SL6 loudspeaker system (left) carried off Japan's Stereo Grand Prix Award. Although a very compact design, the SL6 has a 100-watt rating. Each unit is tested in an anechoic chamber and under microcomputer control, its performance being displayed on a CRO and printed out for a permanent record. (Celestion International, Ditton Works, Foxhall Rd, Ipswich, Suffolk IP3 8JP, England).

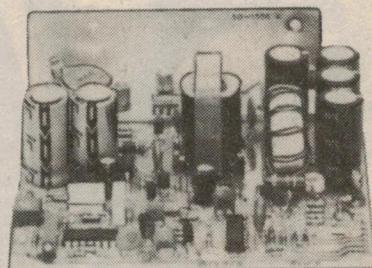
TANDBERG have announced a new TCCR 530 computer-controlled audio recorder cassette, based on their 500-series professional cassette recorder. It has a similar long-life 4-motor drive system with dual capstans, but the control system has been redesigned to simplify control from an external computer — be it a

single-chip microcontroller or a mainframe system. It is equally suitable for audio information or data or digital data and has obvious application to public announcement systems, automated broadcasting and computer assisted teaching.

Inquiries to Rank Electronics Pty Ltd, of 16 Suakin St, Pymble, NSW 2073.

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3T20AP-6115	+10V to +60V	+4.5V to +15V, 20A
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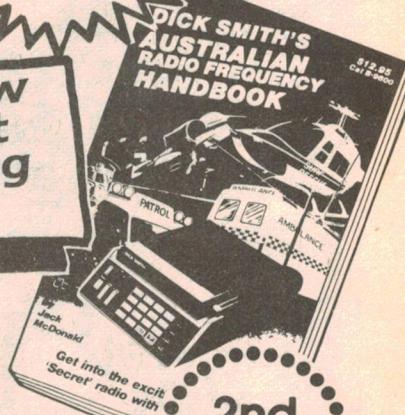
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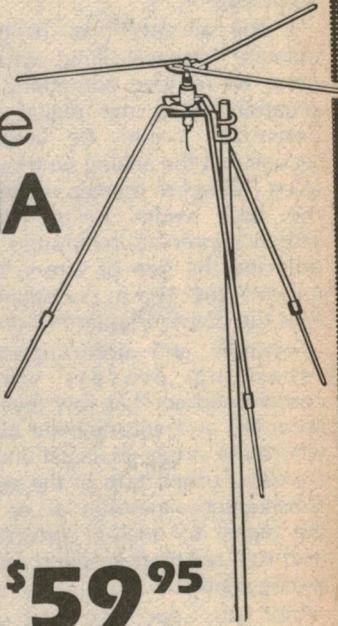
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SCAN X ANTENNA

You'll wonder where all those extra stations came from! Scanner experts agree to get the most from your scanner, an outside antenna is virtually a MUST. Until now, the choice has been pretty limited. But here's the new SCAN-X to solve that problem. Ultra-wide bandwidth (65 to 520 MHz), and it comes complete with mast clamps & 5 metres of cable ready to assemble and put up. It will also stand alone on a patio, roof, etc, if you don't wish to mount it on a mast.

Cat D-4430



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Letters to the editor

Distortion in compact audio discs

Currently there is evidence of a concerted drive to promote sales of compact disc equipment which operates on what appears to be a flawed design principle. If one operates at levels of about 1.5% of maximum signal level (not unrealistic for quieter passage of orchestral music) the errors due to bit size limitations will be around 0.1%.

Also the deviations will be sharp edged with significant high frequency components and, except for tones which are submultiples of the sampling frequency, will be associated with non-harmonic distortion. The resulting effect will (must) be as bad as and probably more severe than cross-over distortion in its audible effect. It seems inevitable that acute listening fatigue will result in the long term, although initially the listener may be seduced by the absence of background noise.

The end result can only be disillusionment for the purchaser. Similar effects are discernible already in many digitally mastered analog discs even though masked by background noise to some extent.

If one accepts that 16 bits is the ultimate practical limit, what can be done to retrieve something from the situation? First, the digital to analog converter could be designed to reconstruct the analog synthesised signal using isosceles triangle shaped pulses, the base width being exactly two sampling intervals in duration. While not reducing the size of errors, this would remove the sharp discontinuities and thus the higher frequency content.

Secondly, and more importantly, the recording process should be compressed so that low level music is recorded at a substantially higher level where the errors of digital encoding are a smaller proportion of the signal level. Subsequent expansion at or following the digital to analog converter would lead to a restoration of the range of the analog signal.

Prior dbx encoding and post dbx decoding of the analog signals would appear to be suitable. The absence of background noise should avoid any obvious pumping effects. For high fidelity reproduction, the encoding and

decoding should be accurately matched.

At the recording stage there would be no economic difficulty in precision dbx encoding. Accurate dbx decoding during reproduction would not present a problem especially if incorporated into the digital to analog decoder. However, one would expect moderate errors in matching dbx decoding to dbx encoding would be audibly more tolerable than the fatiguing effects of errors due to finite bit size in the digital process.

I believe it is important that such steps be taken quickly while yet there is only limited software available. Failure to come to grips with the problem will lead to disillusionment and many unhappy customers.

H. W. Holdaway, MIREE,
Coogee, NSW.

Beware that old B/W monitor

After convincing my wife that my need for a microcomputer was more than I could bear, she reluctantly sanctioned the purchase on the understanding that no extra expense would be incurred for a monitor, and that I would modify an

old B/W TV for visual display.

There are obviously lots of micro beginners like me out there who cannot afford the extra expense of a monitor "off the shelf". This is supported by EA, hence the article in the August issue on a "you beaut" video amplifier for correct level and wave insertion.

However, there is one pit that the unwary could fall into. I did, so you can benefit from my belated wisdom.

Old TV sets accumulate a lot of dust and fluff over the years and in my haste to see the results of late nights rigging my old TV up for video insertion, I forgot to clean out the dust from the EHT cage and check for high voltage tracks around the leads and tube.

There I was one rainy night merrily filling the Microbee with program when to my chagrin the TV set went "zap, zap". The humid air had broken down what resistance had remained, and the resultant high voltage transients in close proximity to the Microbee nearly popped its cork.

The Microbee was still thinking, thank goodness, as it came up with "option not fitted" (heaven only knows what the zap asked for). I do have a problem, however, as intermittently on typing "new" the Microbee comes up with "illegal line error".

The moral of the story is that you have a relatively unshielded delicate CMOS device in your micro, so take care to prepare your TV for the marriage to your microcomputer. Failure to do this could make a brand new monitor a cheap alternative to having your micro suffering from a bad case of amnesia.

W. Glasson,
Condolbolin, NSW.

Monitoring Telecom circuits illegal

As you may be aware there has been sold a large quantity of radiocommunications equipment, including scanners, capable of being used to intercept radio communications.

While the court ruled in the Golds V Comerford case that the operation of a receiver for interception purposes without a licence is not an offence under the Wireless Telegraphy Act, I understand that its use to monitor communications carried on Telecom's public automatic mobile radio telephone system (AMTS) would constitute an offence against Section 7 of the Telecommunications (Interception) Act 1979. Furthermore if a person prints or publishes any writing which incites, urges, aids or encourages any person to commit the above offence, it may constitute a breach of Section 7A of the Crimes

Act 1914. That Section creates the offence of incitement to break Commonwealth or Territory laws.

I feel it is my duty to draw the above matters to your attention, and also to point out the need for care in publishing technical articles and advertisements for radio communications equipment in your magazine to ensure that you do not encourage the unlawful use of receivers. In particular, references in advertising material to the ability of certain receivers to intercept radiocommunications carried on Telecom's public automatic mobile radio telephone system should be carefully considered.

M. R. Ramsay,
First Assistant Secretary,
Radio Frequency Management
Division,
Department of Communications.

Software for the Super-80

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The game of Othello, or Reversi, is played on an 8 x 8 grid with counters of two colours. This one has a "help" option.

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Note: this book is exclusive to, and available only from, Electronics Australia, 57 Regent Street, Chippendale, NSW, 2008. PRICE \$4.00 or by mail order from Electronics Australia, PO Box 163 Chippendale, NSW, 2008. PRICE \$5.00.

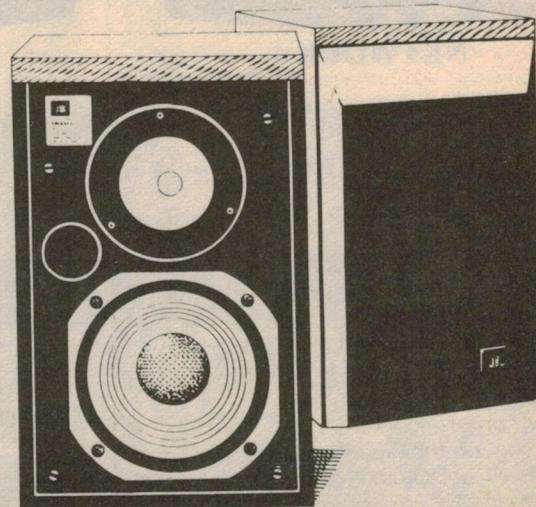
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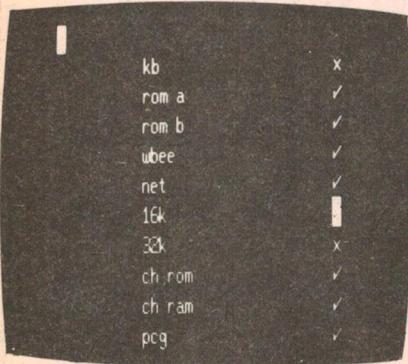
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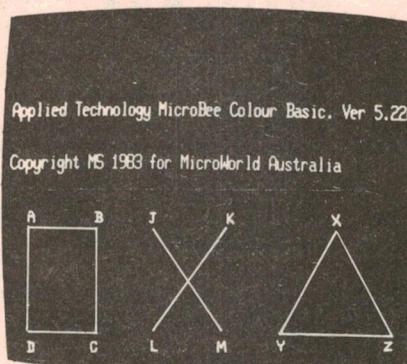


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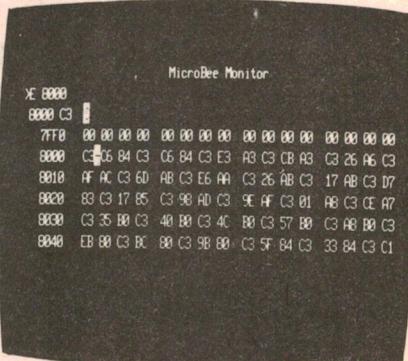
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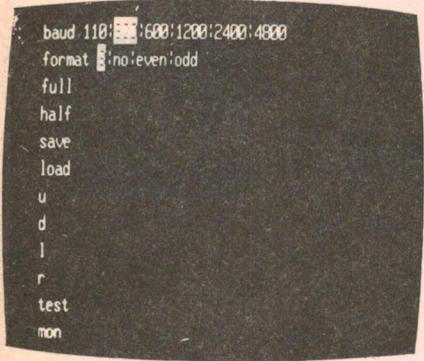
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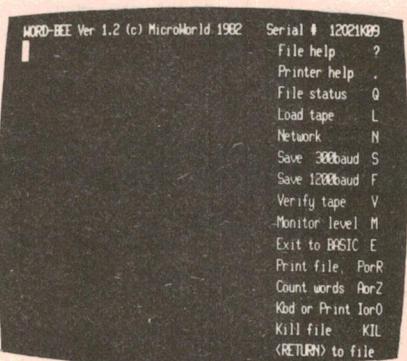
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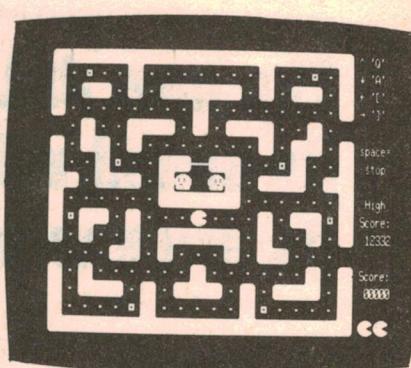
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YAMAHA R100 Stereo Receiver

The Yamaha R-100 receiver this month is one of the most interesting pieces of equipment we have seen in a long time. Containing virtually "everything that opens and shuts" it uses a microprocessor to control most of the receiver functions.

In line with the trend toward increased consumer equipment complexity, Yamaha have released a new 100 watt, top-of-the-line receiver, the R-100, which contains probably the most features we have ever seen packed into one receiver.

Chief among these features would be the microprocessor system which automatically controls many of the receiver's functions.

Other features included in the tuner section are: a digital readout of the band and frequency, a LED tuning meter, automatic station search, local and distant tuning modes with automatic switching between the two, a ten-station tuner memory and a blend facility which helps reduce high frequency hiss in weak FM signals.

The amplifier section of the receiver also contains a host of features and these include switching for two sets of

speakers, a spatial expander, a dynamic noise canceller, a switchable moving coil or moving magnet phono preamplifier, an auto phono function, tape dubbing facilities and a five band equaliser called the CCSS or Computer Controlled Sound System.

Perhaps the best feature of the R-100 is the infrared remote control unit, the RS-100. This is included in the basic price of the R-100 and allows virtually full control over the R-100 from the comfort of your armchair.

With the RS-100, the user may turn the R-100 on or off, adjust the volume up or down, select between the tuner, phono, video/aux or tape monitor inputs, recall any of the equaliser settings or change one to suit the listening position, or select any one of the ten preset tuner frequencies.

Operation of the R-100 is quite simple but it does take a little time to become

proficient with all the facilities it provides.

Manual tuning is achieved by first pressing the AM/FM button to select the band and then pressing the tuning mode button to place the tuner in the manual mode. Sustained pressure on one side of the tuning button (right side for up, left side for down) will cause the tuner to shift frequency in the desired direction. Short touches on the button step the tuner in increments of 50kHz on FM and 9kHz on AM.

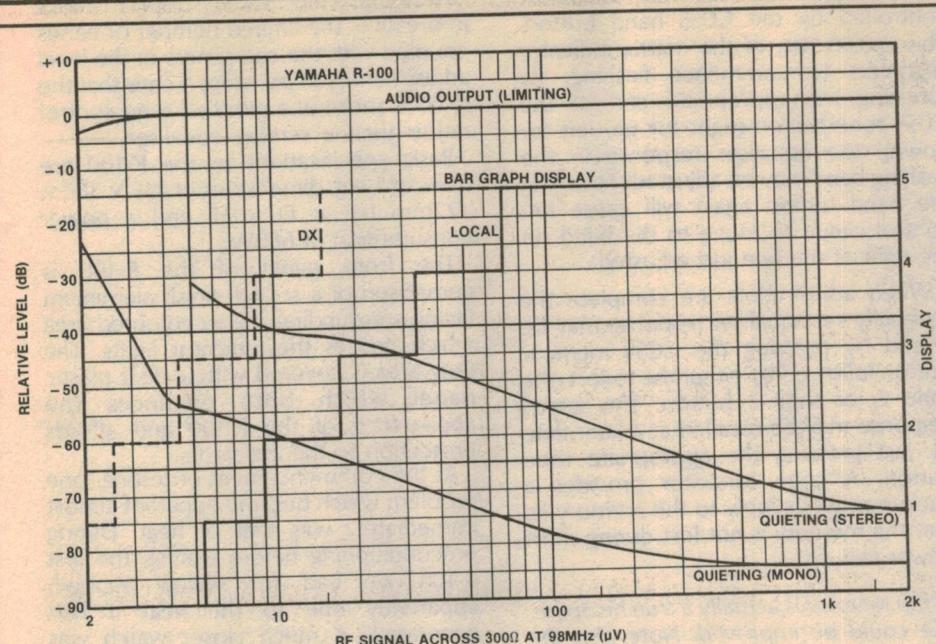
Automatic tuning is also provided on the R-100. To operate, the AM/FM button is pressed first to select the desired band, then the auto mode is selected via the tuning mode button. A touch on one end of the tuning button (right for up, left for down) will cause the tuner to scan through the selected frequency band until a station is located.

If no station is located by the end of the band, the tuner will jump to the other end of the band and begin scanning from there.

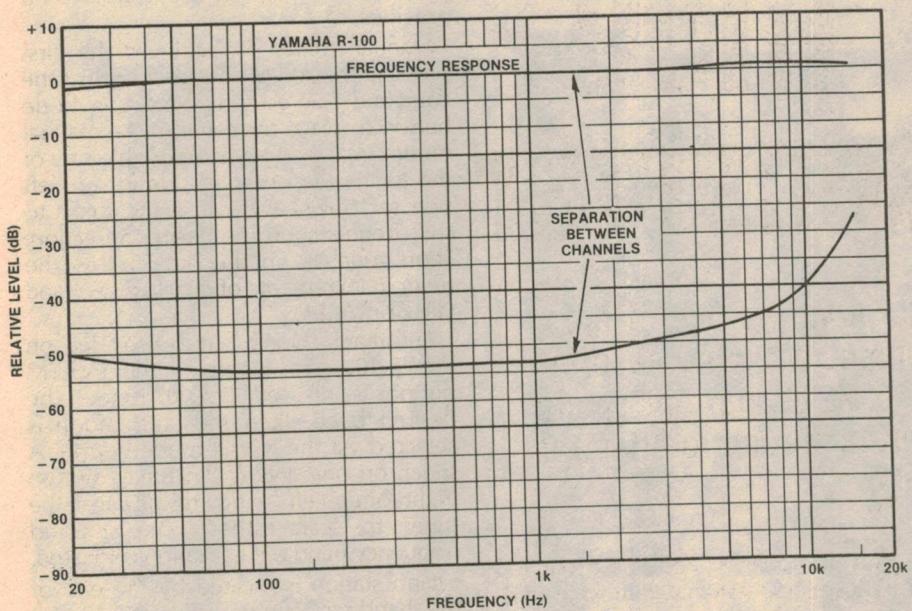
To enter a station into the tuner memory, the receiver is first tuned to the desired station then the memory button is pressed followed by one of the station preset buttons. The tuner will now remember both the station frequency and the band.

Up to 10 station frequencies can be stored in any order with no limits on the mixture of AM and FM stations. To recall a station from memory just press the appropriate station preset button on either the receiver or the remote control and the receiver will jump to the preset frequency.

Muting is applied to the receiver output during tuning and is not removed until the tuner frequency has remained



The signal strength bar graph has two levels of sensitivity, for DX and local reception.



steady for approximately two seconds. This is of little consequence during automatic tuning but makes single stepping in the manual mode quite tedious since each time you increment the frequency it takes about two seconds before the tuner output is heard.

A disadvantage with tuning the receiver manually is that whenever the tuner is placed in the manual mode, the receiver output is in mono. To receive programs in stereo, the tuner must be returned to the automatic mode after the desired station has been tuned in. This is not a serious limitation, however it is annoying and we cannot see any reason as to why the tuner should be restricted in this way.

The receiver has two modes of FM reception, local and distant. The local mode is used when the station being received has a good strong signal. If the station has a weak signal then the DX mode is used. The receiver may be held in either the local or the DX mode, however for the best reception under all conditions the RX mode switch should be set to the "auto" position.

When this is done, the microprocessor inside the R-100 continually monitors the FM signal and switches the receiver into the mode best suited to the strength of the incoming signal.

A publicity handout on the R-100 makes mention of the fact that it contains two different types of tuning

systems. These are, to quote Yamaha, "a high-precision PLL tuning mode" and a "high-performance FM servo tuning mode" which are automatically selected by the microprocessor to provide the best reception under all conditions.

Unfortunately no further information is provided on these tuning modes so we can only conjecture that the PLL tuning mode is used in the DX position for weak and noisy signals and the servo tuning mode is used for strong local signals where high quality is important.

A high-frequency blend circuit is also provided in the receiver and this works to reduce the hiss present in a weak stereo signal. The blend circuit cannot be controlled manually and is brought into play on weak signals automatically by the microprocessor whenever the "RX mode" switch is in the auto position.

A light emitting diode (LED) signal strength meter is also fitted to the R-100 and this serves to indicate the relative strength of the incoming signal. Although there are 10 LED segments, the segments are actually paired so that in reality there are only five signal strength segments. The segment thresholds are changed depending on whether the receiver is in the local or DX mode and both sets of thresholds are shown on the tuner performance graph.

Another feature of the R-100 which we have little information about is the spatial expander. While it does change the signal, whether it enhances the separation or not is open to personal opinion.

The dynamic noise canceller mentioned earlier in the review is actually a sliding low pass filter which follows the upper frequency limit of the program material and removes any higher frequency noise present. This type of noise filter will not work with signals which contain high level, high frequency signals.

The phono preamplifier fitted to the R-100 receiver is a dual purpose device which can handle both conventional moving magnet cartridges and the more exotic low output moving coil cartridges. Only one set of phono inputs is provided on the R-100, with a front panel switch being used to change the phono input from moving coil to moving magnet and back again when required.

The Auto Phono function is a convenience feature which, when selected, automatically switches the receiver's input to the phono mode whenever the turntable tonearm is lowered onto the record at the start of play. The previous input mode is cancelled and record replay starts immediately.

As mentioned earlier, a five band

Continued on page 46

YAMAHA R100 Stereo Receiver

Continued from page 45

equaliser called the CCSS has been fitted to the R-100. Using what appears to be a fluorescent display, a five element by seven element matrix display located in the centre right of the front panel gives a visual indication of the equaliser settings.

Immediately below the display matrix are a row of eight pushbuttons. Five of these buttons recall factory preset equaliser curves with rather descriptive names such as loudness, bass, treble, presence and high filter. The other three buttons are used to store and recall user programmed equaliser curves from the CCSS memory.

The heatsink for the IC power amplifiers in the R100 receiver is actually a true heatpipe. It works well but ventilation through the case could be improved. Note also the motor-driven volume control.

The equaliser may be manually controlled by the CCSS band button. This causes one of the matrix indicator segments to commence flashing. By touching the appropriate end of the CCSS tone button (right for up, left for down), the equaliser response in the flashing band may be adjusted. Touching the band button again will cause the control circuit to move to the band on the right of the one just adjusted.

When adjustments are complete the manually set equaliser response may be stored by pressing the CCSS memory button followed by either the tone 1, the tone 2, or tone 3 button. The stored response may be recalled at a later date by just pressing the appropriate tone button. A large capacitor provides a backup power supply to the memory so that the memory is not lost during short power failures.

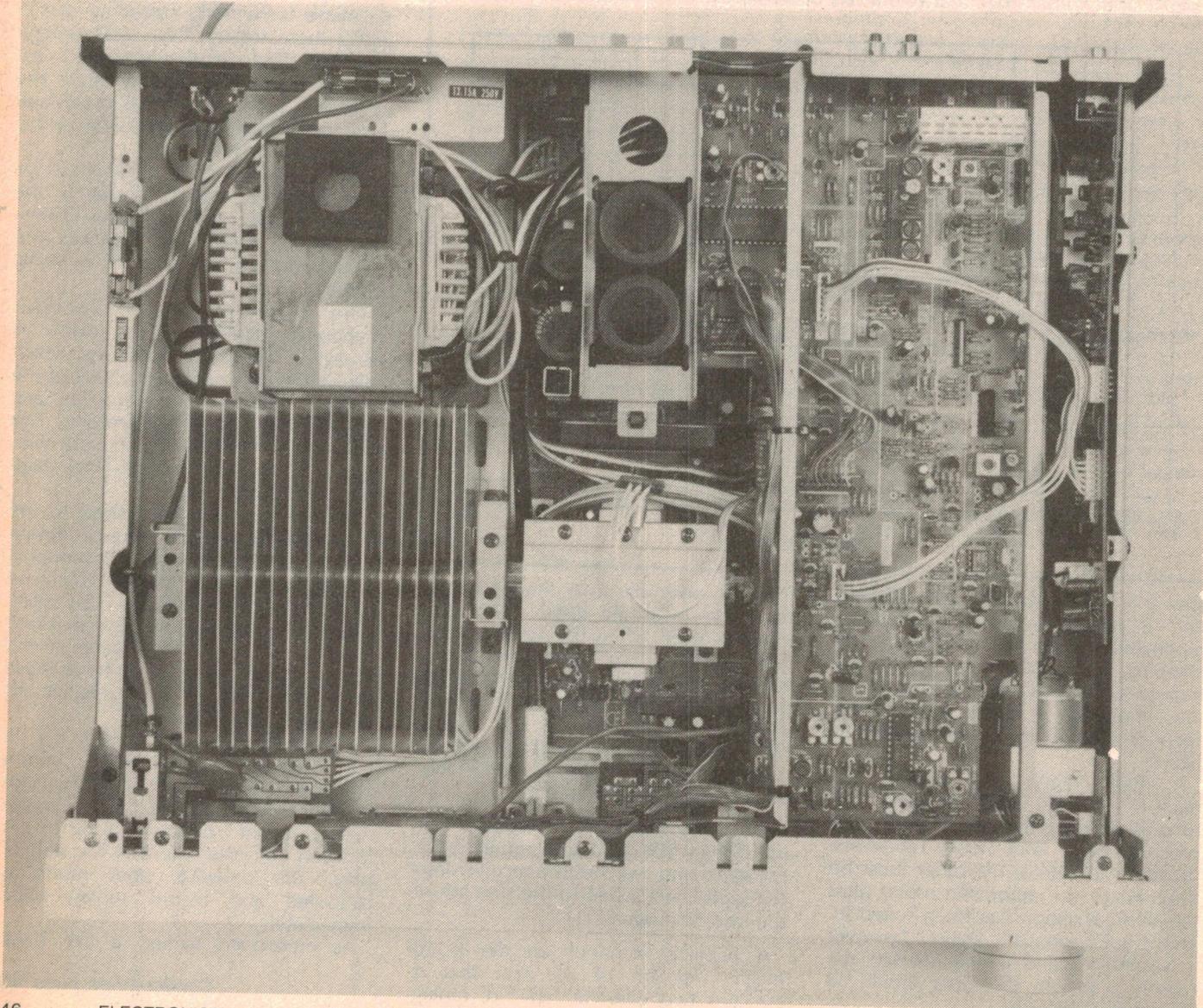
Although the CCSS display looks impressive, the limited number of bands coupled with the coarseness of the level adjustment (4dB per step) means that the CCSS is more of a glorified tone control rather than a serious equaliser.

Basic specifications of the R-100 are mass of 11kg, dimensions of 435 x 386 x 122mm (W x D x H) and a power consumption of 680W.

The front panel of the R-100 is composed of a scratch finish aluminium facing surrounding a grey coloured area which houses the indicator lights. The grey area is covered with a clear plastic panel which both enhances the appearance of the R-100 and affords protection to the indicators.

At the commencement of testing, one problem which became apparent almost immediately was that of heat. During preconditioning before testing, the first R-100 we had for review expired, apparently due to the heat it had generated. A much closer watch was

Continued on page 49



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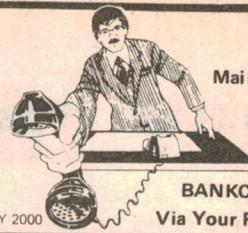
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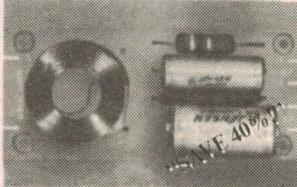


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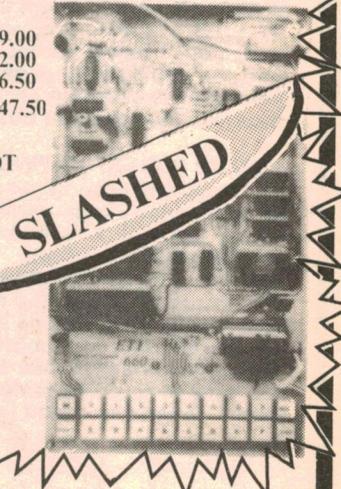
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KE7008	Stereo Simulator Kit	\$19.95
KE7007	Touch Light Dimmer Kit	\$19.95
KE7006	Motor Speed Controller	\$19.95
KE7005	Auto Tester	\$14.75
KE7004	Red Light Flasher	\$20.95
KE7003	Eeprom Burner for Microbee	\$46.50
KE7002	Nicad Charger	\$7.95

PARALLEL INTERFACE KIT FOR
microbee

Includes 15 Pin D Plug
Add \$15.00 if Centronics
plug req'd. KE7017 \$15.00

YAMAHA R100 Stereo Receiver

Continued from page 46

kept on a second R-100 during preconditioning and this was found to get too hot to touch after just 20 minutes (preconditioning lasts one hour according to IHF procedure).

The fault does not appear to be a lack of heatsinking in the R-100 but rather a lack of adequate ventilation for the heatsink which is mounted inside the case.

Admittedly our tests are rather more demanding than a typical home environment, however even playing music at moderate volumes caused the R-100 to become quite warm to touch. Because of this heat buildup, the manufacturer's warning about not placing things over the ventilation holes should be adhered to strictly.

Most of the test results on the tuner section of the R-100 have been summarised into two graphs which allows a quick and easy comparison to be made with other receivers and tuners we have tested.

Looking at the graph of the quieting characteristic it can be seen that 50dB of quieting was achieved in mono mode with an input of 3.8 μ V. The sudden decrease in the quieting at signal strengths below 4 μ V is related to the loss of audio limiting below this signal strength.

Ultimate quieting was 85 dB in mono and 79 dB in stereo, an excellent result. The 19kHz stereo sub-carrier had a measured residual of -50dB while the 38kHz switching frequency could not be measured at all, its amplitude being below the noise.

Total harmonic distortion with a 100% modulated (75kHz deviation) input signal was: in mono mode, 0.058% at 100Hz, 0.037% at 1kHz, and 0.05% at 6kHz. In stereo mode the figures were: 0.067% at 100Hz, 0.047% at 1kHz, and 0.057% at 6kHz. These are very good results and are comfortably inside the manufacturer's specifications.

Audio output limiting was achieved with an RF input of 4 μ V. Frequency response was +1dB at 10kHz and -1dB at 20Hz with respect to 1kHz. Response above 15kHz is not shown since this is affected by the 19kHz filter.

Channel separation was better than 50dB over the range 20Hz to 2.5kHz, deteriorating to 40dB at 10kHz and 27.5dB at 15kHz. This deterioration at higher frequencies is quite normal with FM tuners and is to be expected.

Yamaha specify a power output for the R-100 of 100 watts per channel into an 8 Ω load. We measured the maximum power output at the onset of clipping as 120 watts with both channels driven and 160 watts with a single channel driven. Both these figures were into 8 Ω loads.

At 100 watts into 8 Ω distortion was measured as below 0.006% from 20Hz to 1kHz, rising to 0.024% at 10kHz and 0.045% at 20kHz.

We did not measure performance into 4 Ω loads because of the heat problem mentioned previously and the fact that for A+B speaker operation, Yamaha caution against using speakers of less than 16 Ω impedance.

Power bandwidth of the R-100 extended from 11.5Hz to 20kHz (-3dB points), while the damping factor was measured as 35 with an 8 Ω load at 1kHz. Separation between channels was 79.5dB at 100Hz, 76.5dB at 1kHz and 71.5dB at 10kHz.

Unweighted signal-to-noise ratio on the Aux input measured 92dB with respect

to 100 watts into 8 Ω . The corresponding signal to noise ratio for the moving magnet (MM) phono input was 74dB with respect to an input level of 5mV at 1kHz. This is a good result.

Phono input overload occurred with a 125mV input on the moving magnet position and with an 8.1mV input on the moving coil position. Ultimate sensitivity (to produce 100 watts into 8 Ω) was measured as 2.6mV for the moving magnet phono input and 110mV for the high level inputs.

The harmonic distortion of the moving magnet phono input for a 1VRMS output from the Rec Out socket was just 0.008%, an excellent result.

The performance of the AM section was not actually measured in the review, however we have no reason to doubt the manufacturer's specifications. These are: Usable sensitivity - 250 μ V/m, selectivity - 25dB, harmonic distortion (400Hz) - 0.3%, signal to noise ratio - 52dB. There was no specification for AM bandwidth.

Our overall impression of the R-100 receiver is a little mixed. Although it performed quite well overall, the fact that it runs very warm has us concerned and could lead to problems in the long run.

Some features such as the spatial expander and the computer controlled sound system are little more than gimmicks in their present form and should either be improved or abandoned as they do little but add to the cost.

The Yamaha R-100 receiver carries a recommended retail price of \$1199 and should be available through any Yamaha hifi retailer. For further details on the R-100 and a list of dealers, phone Rose Music Pty Ltd on Sydney 750 8999 or Melbourne 699 2388. (JS)

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Digital Delay Line

The Digital Delay Line is designed to produce a huge variety of electronic effects. It works very well but the amazing thing is the low price! The effects depend on the time delay selected and some of those included are: Phasing, Flanging, Chorus, ADT (Automatic Double Tracking), Echo, and Vibrato. The delay time can be varied from 0.32ms to 1.6 seconds! Because the signal is stored in digital form there is, unlike analog systems, no degeneration of the signal with time and unlimited repetition is provided by use of the freeze control.

All the controls mount directly upon PCB's to eliminate wiring and to further simplify construction the main board is 'plated-through' i.e. there are no wire links or link-through pins. The whole of the memory whether for the basic 400ms machine or the fully expanded 1.6 second model all fits on the main board. The cabinet which is free standing but also suitable for 19" rack mounting, is fully finished to a very high standard. The panel is deep blue whilst the cover is sprayed with a durable black enamel. The kit is available for only \$449 - compare that with inferior units that can cost over \$2,000!!

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400ms VERSION
ONLY

\$449
COMPLETE
KIT

\$449.00



O-30V 1amp power supply

ETI 162

Cat. KE4570

- Fully protected
 - Output variable from 0-30V DC
 - Selectable current limit
 - Both voltage and current metering
 - After a multimeter & soldering iron an absolute must for the enthusiast.
- You will never own a more useful piece of gear.

Ref: ETI
December 1982



\$49.50

LOW COST DIGITAL MULTIMETER KIT

Ref: EA March 1983 (This month)
Almost everyday we are asked for a multimeter kit. Up until now we thought that it was just not worth it to produce a low-cost build-up units available. The DP2010 does this.

This kit, fully imported from the UK uses the famous DPM-05 custom LDC multimeter to achieve phenomenal accuracy at very modest cost!

All components included to complete the meter including an attractive and colourful front panel.

(a 9V battery is required)

Set of test probes to suit \$2.95

Protective case to suit Cat. WTS5312

ONLY \$2.50

Eveready 216 (red)

9V Battery Cat. SB2370

ONLY \$1.40

DP2010 kit Cat. KJ7010
ONLY \$45

SPECIFICATIONS

Function

f.s.d.

Resolution

Accuracy

Protection

(d.c.)

2V

1mV

1%±1 digit

500V for

20V

10mV

1%±1 digit

one minute

200V

100mV

1%±1 digit

500V

100V

1%±1 digit

2A

1uA

1%±1 digit

20mA

10uA

1%±1 digit

200mA

100uA

1%±1 digit

2000mA

1mA

5%±1 digit

2V

1mV

2%±5 digit

500V for

20V

10mV

2%±5 digit

one minute

2000mA

1mA

5%±1 digit

20V

1mV

2%±5 digit

500V for

20V

10mV

2%±5 digit

one minute

2000mA

1mA

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20V

1mV

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20V

10mV

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one minute

2000mA

1mA

5%±1 digit

20V

1mV

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20V

10mV

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2000mA

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1mV

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20V

10mV

2%±5 digit

one minute

2000mA

1mA

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20V

1mV

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500V for

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10mV

2%±5 digit

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20V

10mV

2%±5 digit

one minute

2000mA

1mA

5%±1 digit

20V

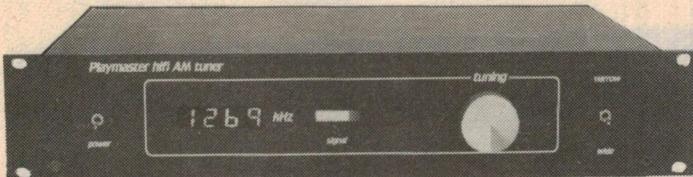
1mV

2%±5 digit

500V for

ENCIES - NO.1 FOR KITS

EA Wideband AM Tuner



Australia is one of the few countries in the world where wideband AM is transmitted. In fact a good quality AM signal can be much better than its FM counterpart!! A wideband AM tuner will give you much better distortion and know what we mean. The Playmaster AM tuner is a true broad-bandwidth superhet design. See the frequency response graph in November EA 1982.

Once again, the Jaycar kit is a high quality approach. Jaycar supplies an exclusive front panel design that differs from the original EA design. The Jaycar kit provides all components to complete the project INCLUDING a completely pre-punched cabinet.

KA-1498

FANTASTIC VALUE
AT ONLY

\$249

Ref: EA Dec-Jan 82-83

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ALIGNMENT KIT AND
STEREO SIMULATOR
WORTH ALMOST
\$20

**OUTSTANDING
VALUE**

"Blueprint" 5000 preamp



\$299

5000 POWER AMPLIFIER

REF: ETI
JAN/MARCH 1981



Cal KE4200

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unbeatable
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ECIFICATIONS:
Signal-to-Noise - 102dB
with resistors 1 Volt
Frequency Response:
12Hz - 105kHz to -1dB
Boost/Cut: 14dB (28dB
total)
Distortion: 100Hz to 0.07%
10kHz to 0.008%
(essentially irrespective of
cut or boost)
Current consumption (DC)
Approx 100mA @ 215V
(there is no power switch)
Output short-circuit proof.

AUSTRALIAN INST HONG KONG!
MADE - SPECIAL BUILT RACK
CABINET - QUALITY!!!

Cal KE4204

\$199
each

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We have decided to discontinue the 2801
MK111 that has RCA sockets fitted on the
back. The 2801 has ETI 5000 Electronics
standard 150 1/3rd octave frequency centres
& a 240V power supply. (After October
the 2801 MK111 will only be available
with professional Canon connectors). You
can save money in October by purchasing
the unit and fitting Canons yourself. There
is no other difference.

Cal. KJ-6530 Normally \$225.00

October ONLY \$199 - SAVE \$26!!

syntom

Original design from the UK magazine
"Electronics and Music Maker" April
1981. Self-contained unit produces a
variety of fixed and falling pitch effects.
Trigger by tapping the unit itself or by
striking a drum to which the unit is
clipped. The Jaycar "SYNTOM" comes
complete with high quality pre-wired
moulded all ABS box, 152 x 80 x 47mm
with professional silk-screened front
panel.

FEATURES: Decay from less than 0.1
second to several seconds, pitch control,
sweep control and volume on/off.



KJ-6502

\$36.50

ETI 330 Car Alarm

Ref: ETI July 1981

This unique design detects the voltage drop that
occurs across the strap that connects the engine
block to the chassis. It does not use wiring inside
the car where false triggering can take place. Kit
comes complete with all components and metal-
work (die cast box) KE-4105 \$29.50

EA dual tracking P/S

Ref: EA March 1982

One of our most popular kits!! Can provide dual
voltages (-) from 1.3V to 22V at up to 2 AMPS.
In addition the supply features a fixed +5V @ 0.9A.
The output is protected against short circuits, over-
loads and thermal runaway.

ONLY \$89 COMPLETE KA-1410



500MHz Period Meter

ONLY \$119

Ref: EA Dec '81 - Feb '82

Jaycar has by far the best kit version of this \$119 (50MHz Version)
project in Australia. We now supply 2 x Cat. KA1392
GOLD plated BNC input connectors at no \$26 (500MHz option)
extra cost!

Digital Frequency

Period Meter



Cat. KA1390

DIGITAL FREQUENCY METER

100MHz to 100MHz
100MHz to 100MHz
100MHz to 100MHz

100MHz to 100MHz
100MHz to 100MHz
100MHz to 100MHz

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100MHz to 100MHz

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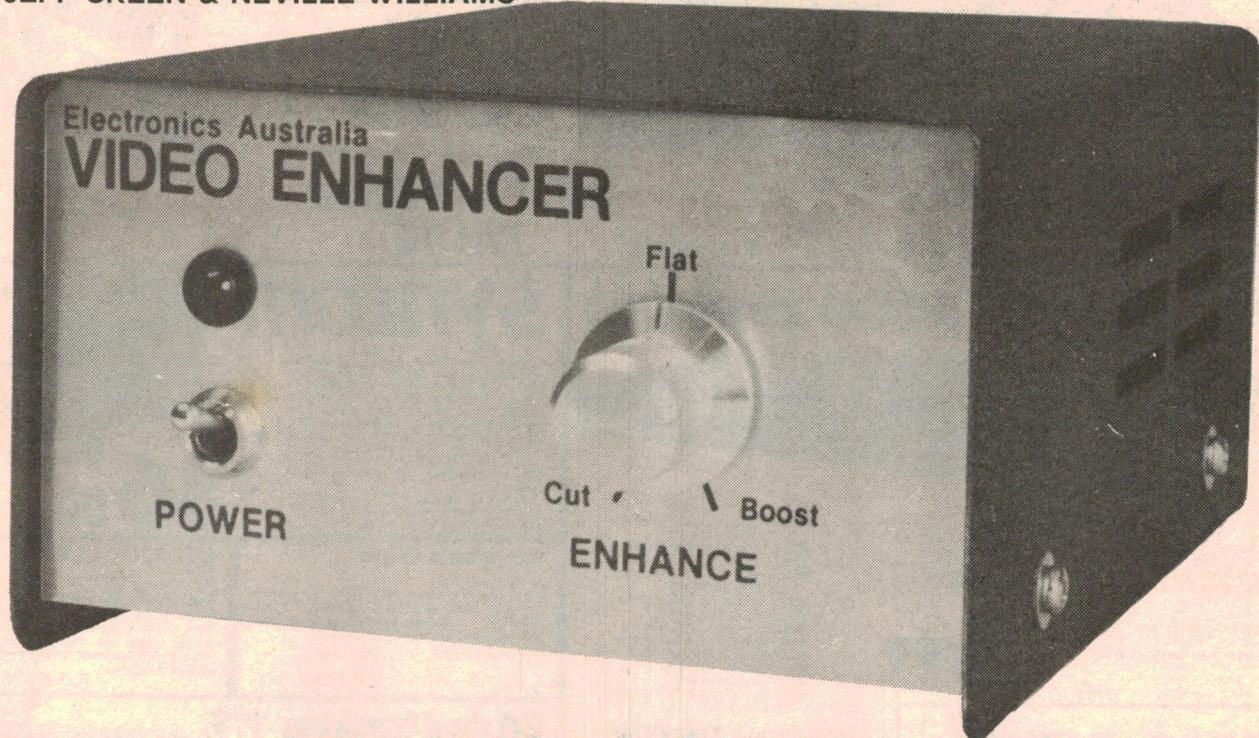
By



BANKCARD
Via Your Phone

Video Enhancer

by JEFF SKEEN & NEVILLE WILLIAMS



Here's an opportunity for video enthusiasts to acquire a simple but effective build-it-yourself video enhancer for a fraction of what a commercial model might cost. But first: what are enhancers supposed to do and how do they work? Well, read on:

At the outset, we should put to rest the fiction that video enhancers are some kind of magic cure-all for a whole range of picture problems. They aren't! Like the tone controls in a hi-fi amplifier, they are meant simply to "touch up" the signal after things elsewhere in the system have been put right.

If the off-air pictures on your TV screen are consistently "noisy" or "grainy", or spoiled by "ghosting", you either live in a very poor area for TV reception, or you need a better antenna system. To install an enhancer, while ignoring the antenna, is very definitely putting the cart before the horse!

Again, if the pictures from your VCR frequently roll, or bend, or wobble, the chances are that your receiver needs to be modified internally to allow it to lock more effectively to the synchronising signals from a VCR. Either that, or the VCR may need attention for dirty or worn heads. Get those matters checked first.

The basic role of an enhancer is —

where possible — to effect a further (and usually modest) improvement in the visual appeal of the on-screen picture. Most commonly, this means making the image more "crisp" by sharpening the outlines and, perhaps, slightly increasing contrast and colour content. Occasionally, it may mean "softening" the picture with the idea of reducing the "grain" or "noise".

In principle, enhancers achieve the foregoing effects by modifying the frequency content of the video signals passing through them.

Selectively boosting frequencies within

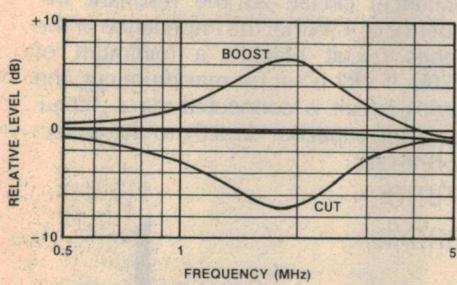
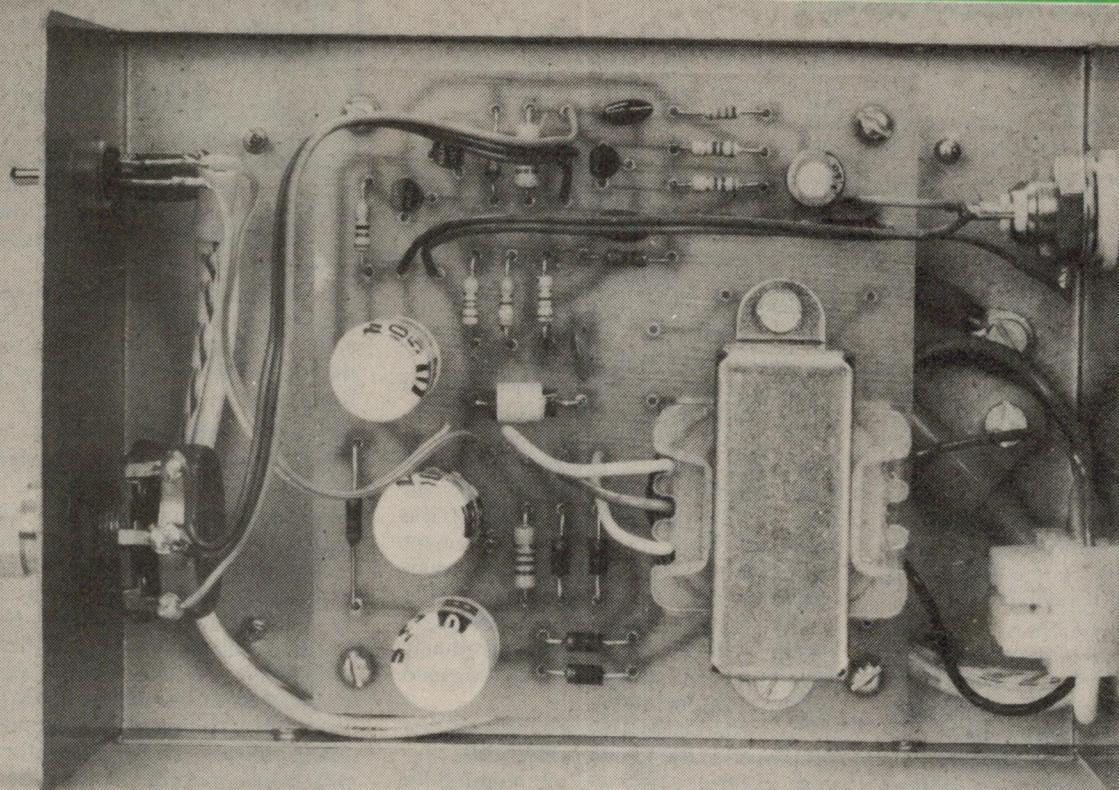
the range from about 1 to 4MHz tends to emphasise picture contrast and outline, usually with an attendant increase in noise content. Attenuating the same range of frequencies has the reverse effect. In between, it is usual to provide for a flat-response, unity-gain condition, where the enhancer is virtually passive, and where the picture can be seen "au naturel" for the sake of comparison.

In practice, the amount of high frequency boost which can be applied to a video signal is usually quite limited, especially where the signal has already been "peaked up" before transmission or

SPECIFICATIONS

Signal to noise ratio
Frequency response (flat setting)
Boost and cut range
Gain
Input impedance
Output impedance

—50dB ref 1Vp-p
1Hz to 6.5MHz —3dB
see graph
0dB
82Ω
68Ω

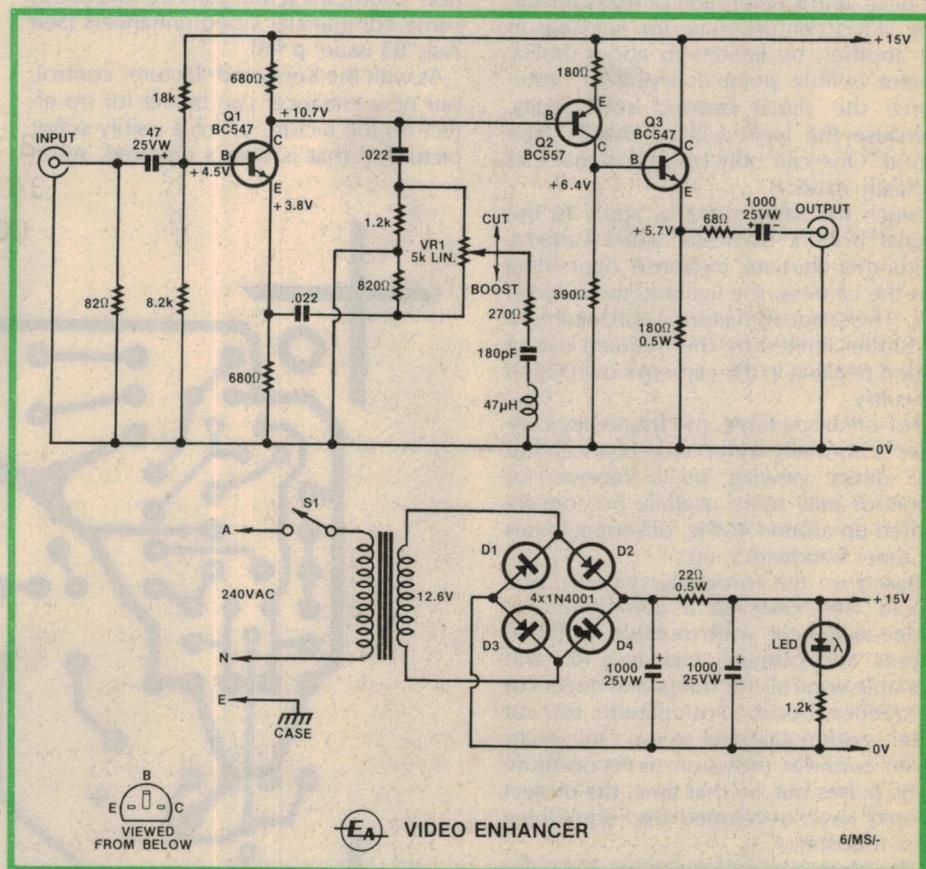


This graph shows the amount of boost and cut available with the enhancer.

before recording on tape. More than about 4 to 5dB of boost is likely to produce an unacceptable increase in noise, or to produce halo effects, with white edges around dark objects, and vice versa. In more technical terms, this would be described as video "overshoot" or "ringing".

Amongst video enthusiasts, enhancers are most commonly used in the following situations:

- Between a home video camera and a VCR. For this purpose, an enhancer needs to be easy to use, as light and compact as possible, and fitted with a socket and plug which allows it to be inserted straight into the camera cable link. Physically and electrically, this is a special case.
- In the video link between two domestic VCRs for purposes of editing or copying from an existing video cassette — legally or otherwise!
- Between a VCR and a TV receiver or



monitor, with the idea of obtaining the sharpest looking pictures from video cassettes.

- Between a TV tuner, or a VCR used as

a tuner, and a jumbo screen receiver or monitor, to sharpen all images, whether from cassette or off-air.

If domestic TV receivers had all been

Video Enhancer

provided with sockets for direct video signal input, the design of enhancers would have been considerably simplified. They could simply have been provided with video input and output sockets (BNC or RCA) and coupled directly into any of the above situations, without further ado.

In fact, most TV receivers to date have had provision only for "RF" input via the antenna terminal. They therefore cannot be fed directly from an enhancer unless it incorporates — or is used in conjunction with — an RF modulator which will provide a composite video/audio signal in an unused TV channel.

Without such a modulator, a video enhancer can be used only between a VCR and monitor, between two VCRs, or between a camera and VCR (if it can be accommodated conveniently).

A further consideration is that video response of an enhancer needs to be optimised, not just in relation to the amount of boost or cut, but the frequency around which it is concentrated.

For example, the video signal from a domestic VCR is unlikely to contain much information beyond about 3MHz at best; with a visibly soft or fuzzy image, the video content may, for one reason or another, be limited to about 2MHz. There is little point in trying to brute-force the signal beyond such limits, because the yield will be mainly tape noise. One can only boost a signal that actually exists!

Much the same remarks apply to the signal from a domestic video camera, with the ultimate response depending on the camera, the lighting, the subject, etc. The scope for external enhancement is further limited by the frequent use of video peaking in the camera's own video circuitry.

For off-air pictures, the frequency content is normally wider and enhancement for direct viewing on a receiver or monitor may more usefully be concentrated up around 4MHz, offsetting losses in tuner bandwidth, etc.

Based on the foregoing remarks, one could well envisage a comprehensive video enhancer with multiple switched inputs and outputs, including RF, and variable controls for things like boost/cut frequency, boost/cut amplitude, top cut filter, system gain and so on. One might even consider provision to reconstitute sync pulses but, by that time, the project would have developed into something of a monster.

This time around, we have kept the design right down to basics, with no RF modulator and a single video and output circuit. The gain is unity when fed from and into 70-ohm circuits, and the

response is substantially flat over the whole band when the control is in the physical centre position.

In practice, there are few modulator designs which do not cause a significant loss in video information at frequencies of 2MHz or more. So in a sense, feeding signals through an enhancer and then via a modulator is an exercise in frustration. Significantly those enhancers we have seen which did have an internal modulator were not very effective.

We envisage that the enhancer will be used mainly between two VCRs or between a VCR and a monitor and that its main task will be to sharpen-up images from cassettes which can obviously do with such treatment. That being the case, we have arranged the resonant boost/cut network to have its maximum effect around 2MHz, where there should always be some signal to work with. Above 2MHz, the response gradually reverts to normal, minimising the need for an additional filter.

The basic philosophy is similar to that employed in the Kenwood KVA-502 "Picture" control, which we recommended for its straightforward, unambiguous operation — something that can't be said about some commercial video enhancers (See Aug '83 issue, p 46).

As with the Kenwood "Picture" control, our new enhancer can be set for no effect on the picture or for a visibly softer picture, if that is what's required. Alter-

We estimate that the current cost of parts for this project is approximately

\$35.00

This includes sales tax

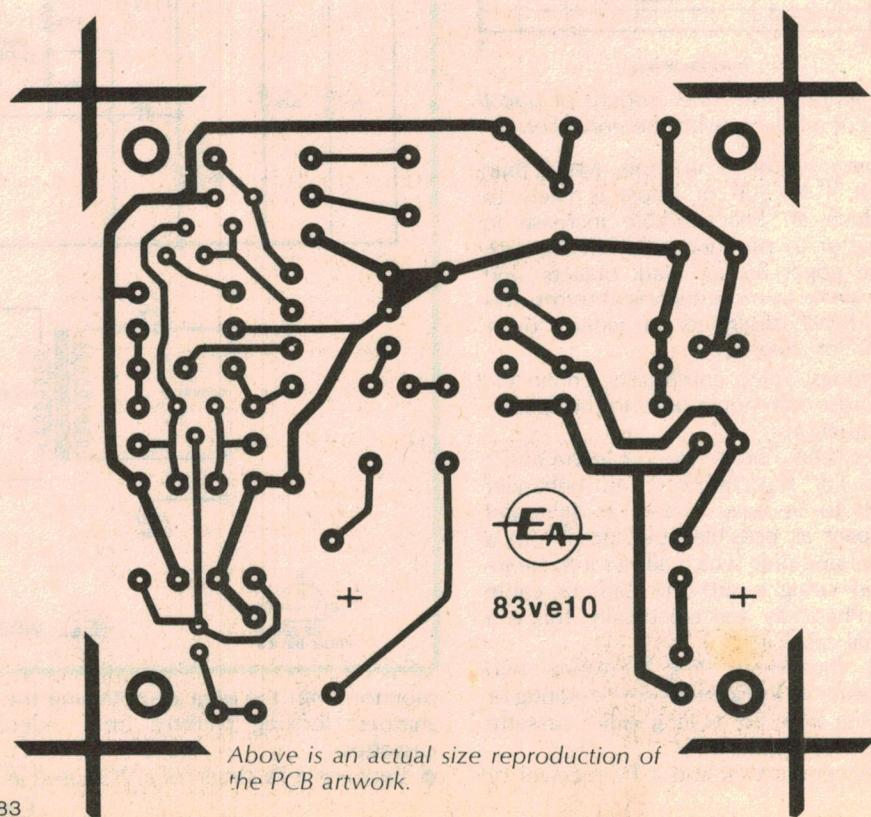
natively, turning the control clockwise beyond centre position allows the outlines to be sharpened to just short of video over-shoot.

If you want to experiment, it is possible to shift the frequency of the resonant circuit by changing one component, as mentioned later. But let's now look at the project in detail:

How the circuit works

Refer now to the circuit diagram. Q1 is connected as a common-emitter amplifier with a nominal gain of one set by the ratio of the collector impedance to the emitter impedance. The network associated with VR1 varies this collector-to-emitter impedance ratio and produces either boost or cut of the higher frequencies in the video waveform, depending on the setting of VR1.

A series resonant circuit composed of a 270Ω resistor, 180pF capacitor and a $47\mu\text{H}$ coil connected to the wiper of VR1 forms the heart of the boost-cut (or enhance) circuit. At the resonant frequency of 1.9MHz, the impedance of the series circuit reaches a minimum of 270Ω . If VR1 is set for maximum cut, the series circuit is connected via a $.022\mu\text{F}$ coupling capacitor directly to the collector of Q1.



Above is an actual size reproduction of the PCB artwork.

TRIO - Still the Best Scopes for Value and Performance

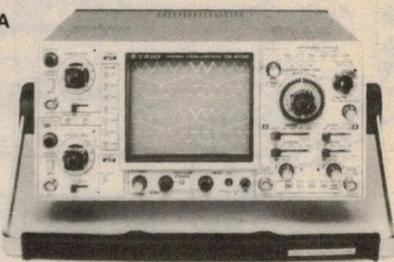
100MHz, 4 Channels, 8 Traces. 1mV Sensitivity!

For applications requiring the highest degree of measurement sophistication, TRIO offers the new 100MHz CS-2100A. A second generation design with a new level of performance and reliability. It brings ultra-high performance standards and a vast array of features into one efficient package. This new scope represents the state-of-the-art and features a rugged industrial construction. As a result, the CS-2100A is efficient, light-weight and highly reliable.

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- 120MHz response at -6dB
- 500μV/Division cascade sensitivity
- 2ns/division sweep rate with 10x magnifier
- Four-input operation provides trigger views or four separate inputs
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- Alternate timebase operation
- 20MHz bandwidth limiter for best view of low frequency signals
- Lighted function pushbuttons
- Voltage and current probe calibrators
- 8 x 10cm internal graticule CRT
- Video sync separator standard
- Dual intensity controls

CS 2100A

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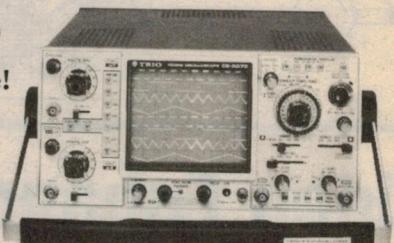
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CS 2070

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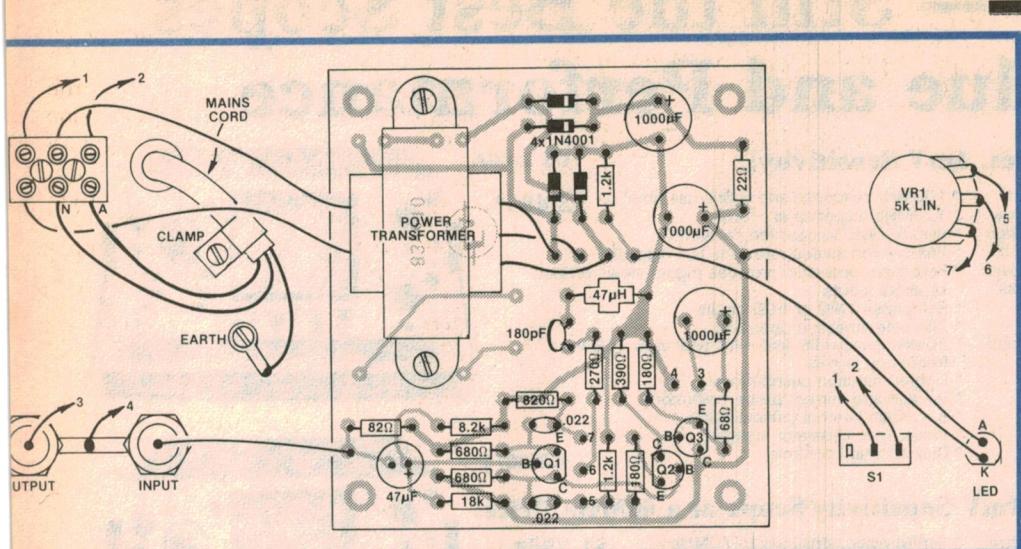


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Video Enhancer

The AC load seen by the collector of Q1 is now reduced because of the low shunting impedance of the resonant circuit. Neglecting secondary effects, the impedance seen at Q1's collector is $270\parallel 680\parallel 1200 = 166\Omega$. The impedance at Q1's emitter is $680\parallel 820 = 166\Omega$. The ratio of these two impedances sets the gain of the stage at $166/372 = 0.446$. This gives a maximum cut of -7dB .

When VR1 is set to maximum boost, the series resonant circuit is connected via a $.022\mu\text{F}$ capacitor to the emitter of Q1. This sets the impedance seen by the emitter of Q1 at $680\parallel 820\parallel 270=156\Omega$. The corresponding impedance seen at the collector of Q1 is $680\parallel 1200=434\Omega$. This sets the gain of the stage to $434/156=2.78$ and gives a maximum boost of 8.9dB.

Any amount of boost or cut between the above limits may be selected by an appropriate setting of VR1. Due to secondary effects such as collector capacitance, the load seen by Q1's collector is in practice lower than we have calculated. This reduces the maximum boost by about 2dB and increases the maximum cut by about 0.6dB.

The non-uniform loading on the collector and emitter of Q1 from secondary effects shifts the "flat" setting of VR1 away from the centre position of the potentiometer. The $1.2\text{k}\Omega$ and 820Ω resistors connected between the ends of VR1 and ground compensate for the uneven

Table 1. Peak frequency versus series resonant capacitor

Capacitor	Frequency
180pF	1.9MHz
100pF	2.2MHz
82pF	2.5MHz
56pF	2.9MHz

loading and shift the "flat" position of VR1 back to the centre of the potentiometer.

Since the impedance of the series resonant circuit rises as the signal frequency moves away from resonance, the amount of boost or cut will be decreased at frequencies away from resonance. The circuit response therefore shows a peak (or dip) which decays away slowly back to the 0dB level.

Following Q1 is a second common emitter amplifier consisting of Q2 and the 180Ω and 390Ω resistors. This stage provides an additional fixed gain of around two which is required for the following stage, as we shall see shortly.

The output of the second stage is direct coupled into the third stage which is an emitter follower based around Q3. This stage acts as a buffer between the high impedance amplifying stages and the low impedance input of a VCR or television monitor.

The signal from the emitter follower is coupled via a 68Ω resistor and $1000\mu\text{F}$ capacitor to the output of the video enhancer. The capacitor AC-couples the signal so that DC bias conditions in the third stage will not be changed by the connection of a load impedance.

The 68Ω resistor in series with the output serves two purposes. First, it provides rough matching for the 75-ohm input impedance of most VCRs. Second, it protects the output stage against short-circuits.

As with any such matching arrangement, there is a signal loss of 50%. To compensate for this loss, Q2 provides a gain of two, as mentioned previously.

Note also that the input to the enhancer circuit is loaded with an 82Ω resistor and this gives rough matching to the output signal from a VCR or video

INPUT

OUTPUT

VIDEO ENHANCER

POWER

ENHANCE

Flat

Cut / Boost

LED

K

A

INPUT

OUTPUT

VIDEO ENHANCER

POWER

ENHANCE

Flat

Cut / Boost

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K

A

Actual size front and rear panel artwork.
camera.

Power for the video enhancer is provided by a 12V centre-tapped transformer. The transformer output voltage is full wave rectified by diodes D1 to D4 and the resulting DC filtered by the first $1000\mu\text{F}$ capacitor. An RC filter network consisting of the 22Ω $\frac{1}{2}\text{W}$ resistor and the second $1000\mu\text{F}$ capacitor provides further supply filtering and results in a supply of 15VDC with about 15mV of ripple.

Power on-off indication is provided by the red light emitting diode (LED) connected to the enhancer power supply.

The frequency at which we have centred our boost and cut circuit gives the best result for enhancement of typical VCR playback signals. In some cases where the signal is of a higher quality (ie, greater bandwidth) the optimum frequency for enhancement will be higher. Table 1 shows the value of capacitance required in the series resonant circuit to achieve a particular centre frequency for boost and cut.

Note that changing the capacitance in the series resonant circuit will not change the amount of boost or cut available, only the frequency at which it occurs.

Construction

Construction is quite straightforward with most parts being mounted on a

small printed circuit board (PCB) coded 83ve10 and measuring 90 x 85mm. Follow the layout diagram when mounting parts on the PCB and take particular care with polarised components. These include the transistors, diodes and electrolytic capacitors.

The PCB is mounted in a small metal instrument case measuring 150 x 103 x 61mm (L x W x H). Four 9mm tapped brass spacers are used to support the PCB and hold it clear of the case.

Holes for the BNC sockets, the terminal block and the mains cable entry point are now marked out and drilled in the back panel. Remember to fit the insulating washers to the BNC sockets and a grommet to the mains cable entry hole.

The mains cable is now inserted through the grommet and suitable locations marked out for the cable clamp and earth lug mounting holes. These holes should be drilled and then the Scotchcal label stuck to the front panel of the case. The Scotchcal label may now be used as a guide for locations of the front panel mounting holes.

Install the components on the front panel and then complete the wiring according to the wiring diagram. Note that 240VAC rated cable must be used for the wiring between the mains switch and the terminal block. If a PCB mounting

transformer is used, 240VAC rated cable is also required between the terminal block and the transformer primary input on the PCB.

With construction completed, go over the unit and check for possible wiring errors. In particular, check that the mains wiring is correct and that the job is done in a workmanlike manner. The switch terminals should be sleeved with plastic

tubing to prevent the possibility of electric shock.

Finally, some people may wish to run two VCRs or maybe one VCR and one television monitor from the output of the video enhancer. To do this just substitute a 39Ω resistor for the 68Ω output resistor and add a second BNC socket in parallel with the existing output socket.

PARTS LIST

- 1 Instrument case, 150 x 103 x 61mm (L x W x H)
 - 1 PCB, code 83ve10, 90 x 85mm
 - 1 Scotchcal front panel, 111 x 55mm
 - 1 12V centre tapped transformer, AL7VA/12, PL2/5VA or PF2851
 - 1 SPST 240VAC rated toggle switch
 - 1 mounting bezel to suit light emitting diode
 - 2 insulated BNC panel mounting sockets
 - 1 3-way mains terminal block
 - 1 mains lead and plug
 - 1 grommet to suit mains lead
 - 1 cable clamp to suit mains lead
 - 1 solder lug
 - 4 9mm tapped PCB standoffs
 - ½ metre 240VAC rated mains hookup wire
 - ½ metre 3-way ribbon cable
 - 1 front panel knob
 - 10 sets of nuts and bolts for mounting hardware
 - 1 47µH RF choke
- SEMICONDUCTORS**
- 4 1N4001 diodes
 - 2 BC547 NPN transistors
 - 1 BC557 PNP transistor
 - 1 red light-emitting diode
- CAPACITORS**
- 3 1000µF 25VW PC mount electrolytics
 - 1 47µF 25VW PC mount electrolytic
 - 2 .022µF greencaps
 - 1 180pF ceramic
- RESISTORS (1/4W, 5% unless stated)**
- 1 x 18kΩ, 1 x 8.2kΩ, 2 x 1.2kΩ, 1 x 820Ω, 2 x 680Ω, 1 x 390Ω, 1 x 270Ω, 1 x 180Ω, 1 x 180Ω 1/2W, 1 x 82Ω, 1 x 68Ω, 1 x 22Ω 1/2W, 1 5kΩ linear potentiometer.

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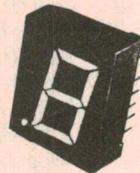
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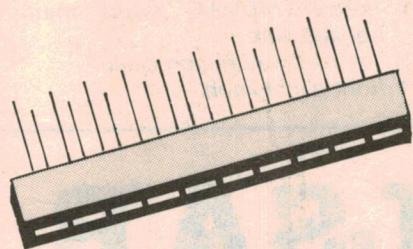
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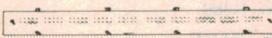
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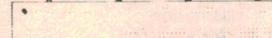
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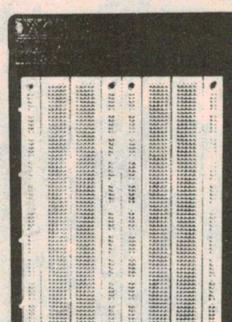
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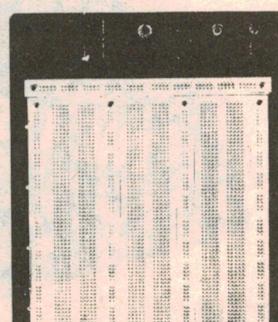


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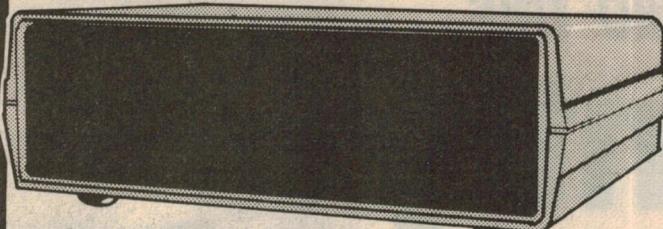
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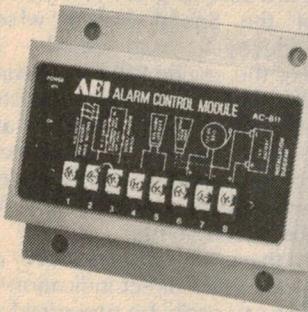
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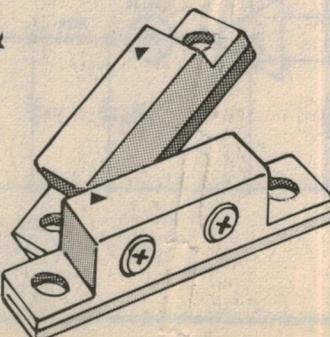
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Paying speeding fines can be a painful business. Build this speed sentry and avoid further pains in the wallet due to this cause.



It's a situation familiar to every driver: a long stretch of good road leads you to imperceptibly increase speed. After a while you can be exceeding the speed limit by a wide margin which means that you're a goner if you stumble upon a roadside radar trap. It could well be a case of the book, the bag and a large extraction from the wallet.

Similarly, driving into a built-up area after a long stretch of highway can make the 60km/h restriction seem like an agonising crawl. Constant vigilance is required to keep the speed under the limit, but clearly, the driver's attention should be directed outside the car – not at the dashboard. In such cases, the warning buzzer of the Speed Sentry will greatly assist in re-orientating the driver to the lower speed limit.

The Speed Sentry actually has two alarm speeds. One of these is set at installation and would normally be calibrated to trigger at about 60km/h.

The other can be adjusted on the move by means of a remote potentiometer mounted in any position convenient to the driver. Selection between the two alarm speeds can be made by a switch mounted near the potentiometer.

When the driver does not need the Sentry, it is simply switched to the adjustable mode and the trigger speed set to maximum.

The original version of the Speed Sentry, presented in May 1981, interfaced to the car's ignition system. In fact it was monitoring engine speed rather than road speed, but provided the car is in top gear this is a valid technique. By calibrating the circuit to trigger at a given engine RPM, it is also being calibrated to trigger at a given speed. Unfortunately, this type of monitor will also trigger at this same RPM in the lower gears even though the speed is well below the preset value. And it was not really valid for cars with automatic transmission.

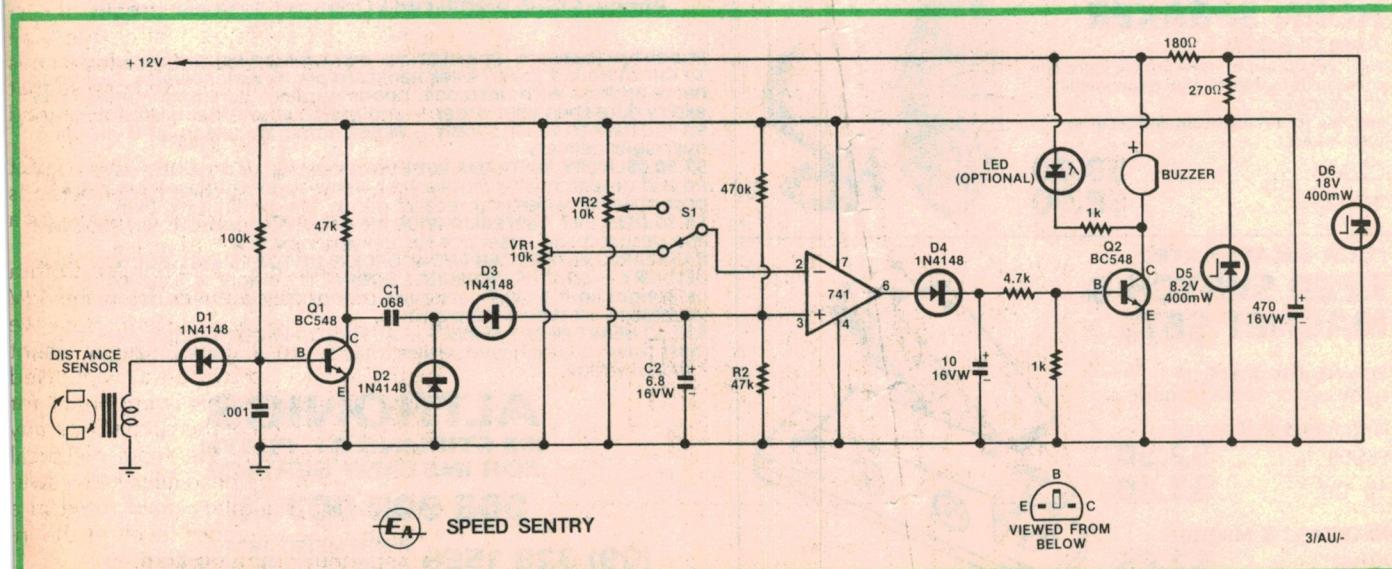
We estimate that the current cost of components for this project is approximately

\$11

This includes sales tax but not the cost of the sensor.

Now we are able to present a revised version of the Speed Sentry which responds directly to road speed — irrespective of the engine RPM. Following the introduction of our car computer project last year, several retailers are supplying the distance transducers specified for that project. As it happens, these transducers are equally suitable for use with the Speed Sentry.

Although these transducers have an output which gives a direct indication of distance, this can easily be processed so that it represents speed. For vehicles already fitted with the car computer, no





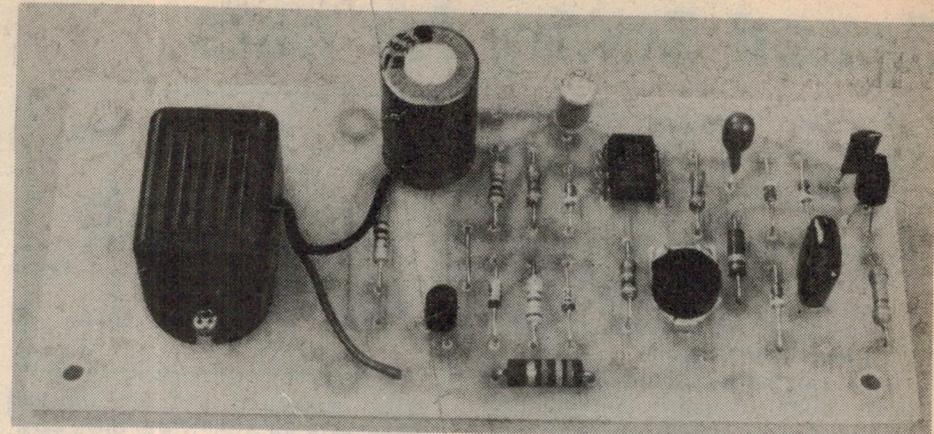
modification to the sensor circuit will be necessary. The Speed Sentry will simply require a "tap" from the output line of the sensor. This could be taken from any convenient point between the sensor and the computer.

There are two different types of distance sensors available, both of which can be used with this project: (1) a magnetic pick-up using a coil and rotating magnets, or (2) a speedometer cable sensor. Generally, the magnetic pick up system will suit most rear-wheel drive cars with a front mounted engine as the tailshaft is an ideal position for the magnets. It may also be possible to find a suitable position on some front-wheel drive cars.

The cost of the speedometer cable sensor is about \$20, but the driveshaft sensor is cheaper at about \$12. Actually, it is quite practical to manufacture your own driveshaft sensor. All you need is a coil and two reasonably strong magnets. We are aware of one reader who used

Right: parts layout and wiring diagram for the speed sentry. Take care with polarised components

The circuit (left) consists of a diode charge pump, an op amp comparator and a transistor output stage.



The components are all mounted on a small printed circuit board.

an old washing machine solenoid for the coil. Large relay coils could prove equally suitable for the purpose and the magnets are available commercially.

With either type of sensor the output is a series of pulses, for which the frequency is dependent on the speed of the vehicle. From this, it is apparent that the Speed Sentry is actually a frequency sensing circuit. In fact it utilises a diode charge pump to produce a DC level which is proportional to the frequency of input pulses. When this DC level exceeds a preset reference (as determined by an op amp comparator) an alarm condition exists and the warning buzzer sounds. An optional LED can also be used to signal the warning.

The output of the magnetic sensor cannot be used to drive the charge pump directly, since the amplitude of the pulses tends to vary with RPM. Instead, the sensor is coupled to Q1 via a diode, D1. By virtue of the diode, the base of Q1 is held at 0.6V.

With no signal supplied from the coil, Q1 is on the verge of being forward biased, hence only a very small signal from

the coil is needed to bias it into conduction. As soon as Q1 is forward biased, its collector goes low. Since the coil is rotating rapidly we can expect that Q1 will be on only briefly with its collector then being pulled high by the 47kΩ resistor. Each one of these positive transitions counts as an input pulse.

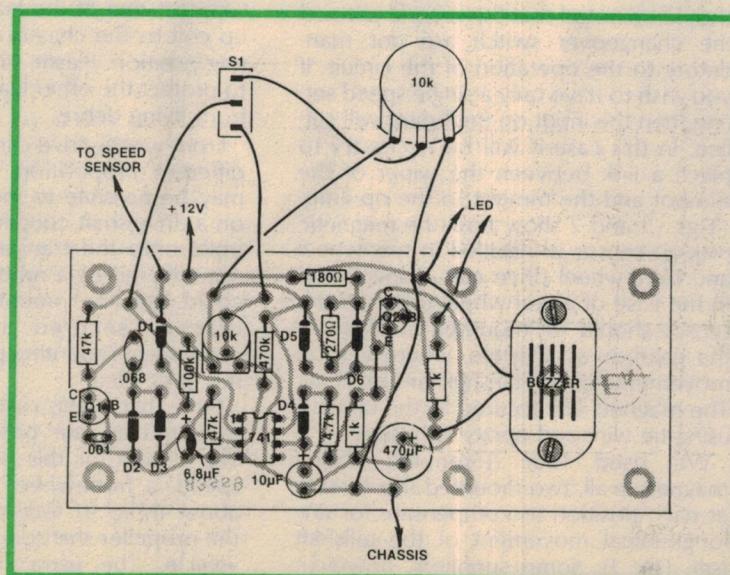
The speedometer cable sensor has an integral buffer transistor which serves the same purpose as Q1. This means "squared up" pulses can be taken directly from the sensor, eliminating Q1 and its associated circuitry from the Sentry. The disadvantage with this sensor – besides more difficult mechanical installation – is that it must have a power supply connection to the Sentry circuit.

Although Q1 provides pulses of constant amplitude, the pulse width is still determined by vehicle speed. With faster driving the pulses become shorter and shorter. To provide a pulse of constant duration for the charge pump, the signal from Q1 is differentiated by C1. This converts each pulse into a short spike, the duration of which is independent of vehicle speed.

The signal spikes are transmitted via diode D1 to C2, which consequently acquires a certain amount of charge. The 47kΩ resistor across C2 allows this charge to bleed off at a fixed rate so that the voltage across C2 can be determined by the rate of input pulses.

Reference to the complete circuit diagram shows that the charge pump is followed by a comparator consisting of a 741 op amp and two trim pots.

The op amp (IC1, a 741) is fed from a regulated supply, derived from the 12V of the car's electrical system. Here we have used an 8.2 volt zener shunt regulator to provide a stabilised operating voltage. This is important for reliable operation of the circuit since any voltage changes in the main electrical system (due to the headlights being switched on for example) would result in a change in the reference levels at the inverting input of the op amp.



Speed Sentry for cars

The voltage developed across C2 is applied to the non-inverting input (pin 3) of IC1, while an adjustable reference voltage is applied to the inverting input (pin 2). If the voltage on pin 3 is lower than the voltage on pin 2, the output (pin 6) will be close to 0 volts. As soon as the voltage on pin 3 rises above that of pin 2, the output will rise to almost 8.2V (the zener regulated voltage).

The output of the op amp is fed to a second diode/capacitor combination which is used to smooth any pulses appearing there. Where the voltage across the capacitor in the charge pump circuit is just at the threshold level of the comparator, pulses will appear at the output, due to the ripple at the input. This ripple is due to the charging and discharging of the capacitor with the input pulses.

This smoothed voltage at the output of the op amp is used to drive transistor Q2 which is a saturating switch for an oscillator-driven buzzer or a piezo alarm device.

The purpose of the 18V zener diode across the power supply of the Sentry is to clip any high voltage spikes that may occur on the car's electrical system. This protects the IC from the spikes which are quite common.

Power for the circuit should be taken from a part of the car's wiring which is active when the ignition is switched on.

Fig. 1. Magnetic pick-up sensor system for rear-wheel drive cars. Note the twin magnet arrangement.

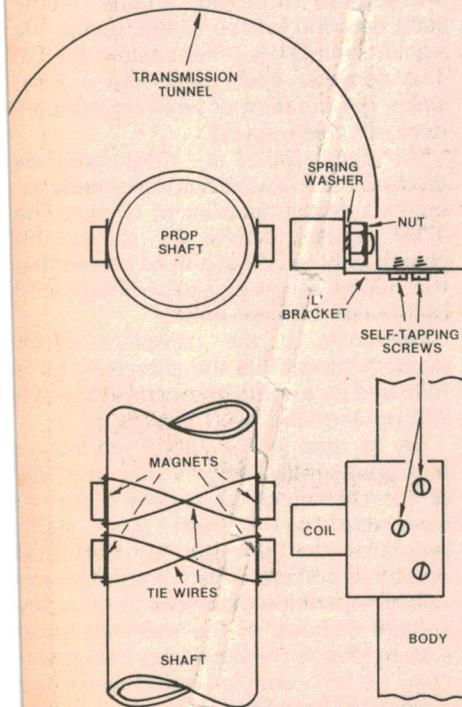


Fig. 1

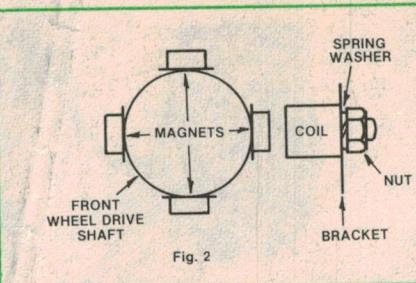


Fig. 2. Suggested coil and magnet arrangement for front-wheel drive cars.

We have designed a printed circuit board which accommodates all the components except the sensor, the second potentiometer and the changeover switch. The board measures 117 x 52mm and is coded 83ss9. Construction is simple and should not take more than half an hour or so. The components should be mounted in the usual order; starting with resistors and diodes, then capacitors, transistors and lastly the IC. The wire link on the board should be soldered in at the same time as the resistors.

We have made provision on the board for an additional 1kΩ resistor which allows a series LED to be connected in place of the buzzer, or if desired, in parallel.

If using the speedometer cable sensor, omit D1, Q1 the associated 100kΩ and 47kΩ resistors and the 0.001μF green-cap. What was the collector of Q1 now becomes the input.

The external connections to the board are the input, power supply, the switch and the external potentiometer. This is shown in the wiring diagram.

The remote pot and the changeover switch can be mounted on the dash, or, if your car has it, in the centre console. It should be noted that the second pot and the changeover switch are not mandatory to the operation of the circuit. If you wish to have only a single speed setting then the input on the board will suffice. In this case it will be necessary to place a link between the wiper of the trimpot and the trimpot to the op amp.

Figs. 1 and 2 show how the magnetic pick-up sensor is installed in rear-wheel and front-wheel drive cars respectively. In the case of a rear-wheel drive car the sensor should be mounted as close to the gearbox as possible, where vertical movements of the tailshaft are minimal. The magnets are secured to the tailshaft using tie wire and epoxy adhesive.

We used four 15mm-dia round magnets in all, two mounted side-by-side at each position to compensate for any longitudinal movement of the tailshaft (see Fig. 1). Some suppliers, however,

Parts List

- 1 printed circuit board 117 x 52mm, code 83ss9
- 1 switch, single pole double throw (SPDT)
- 1 buzzer
- 1 knob to suit potentiometer

SEMICONDUCTORS

- 1 741 op amps
- 2 BC548 NPN transistors
- 4 1N4148 diodes
- 1 18V/400mW zener diode
- 1 8.2V/400mW zener diode
- 1 LED (See text)

CAPACITORS

- 1 470μF/16V electrolytic
- 1 10μF/16V electrolytic
- 1 6.8μF/16V electrolytic
- 1 .068μF metallized polyester (greencap)
- 1 .001μF greencap

RESISTORS (1/4W, 10%)

- 1 x 470kΩ, 1 x 100kΩ, 2 x 47kΩ, 1 x 4.7kΩ, 2 x 1kΩ, 1 x 270Ω, 1 x 180Ω, 1/2W, 1 x 10kΩ linear potentiometer, 1 x 10kΩ trimpot small horizontal.

will provide 25mm-long bar magnets, in which case only one magnet will be required at each position.

The coil was mounted on an L-shaped bracket made from aluminium and secured to the underside of the car using self tapping screws. This bracket should be positioned so that there is a 10mm gap between the end of the coil and the magnets when they are directly opposite each other.

Wiring to the coil can be run along the underside of the car, with the leads secured at various points as convenient. Connect one of the leads from the pick up coil to the chassis at the coil mounting position. Plastic tubing can be used to protect the other lead against damage from flying debris.

Front-wheel drive cars are a somewhat different proposition. In some cars, it may be possible to mount the magnets on a drive-shaft coupling flange where it bolts onto the transaxle (provided it is not covered by a rubber boot). The coil could then be mounted on a suitable bracket secured to the nearest convenient mounting point. Fig. 2 shows the basic idea.

Note that in this case the magnets are mounted at four positions, 90° apart. The reason for this is that, for a given speed, a front-wheel driveshaft rotates about three to four times slower than the propeller shaft on a rear-wheel drive vehicle. The extra magnets are thus

necessary in order to get a similar number of pulses for a given distance.

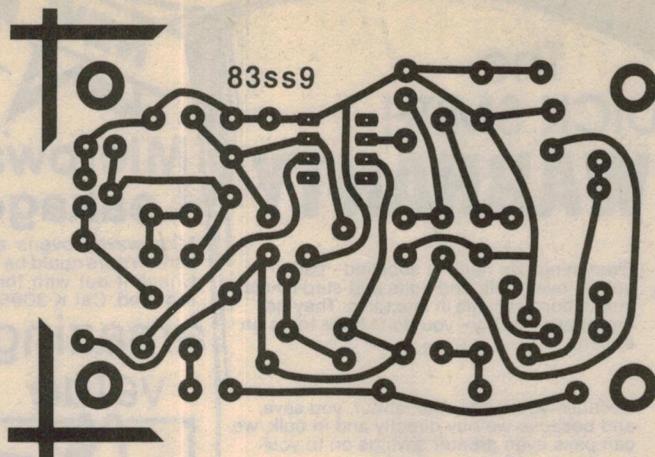
Do not mount the magnets directly onto one or other of the driveshafts. They move about too much when the vehicle is in motion to allow for reliable coupling between coil and magnets.

The alternative speedometer cable sensor can be used with both front and rear-wheel drive cars, but is mainly applicable to front-wheel drive cars where the driveshaft flanges are not accessible. In order to fit it, the outer sheath must be removed from the speedometer cable and cut at a suitable point. The inner cable is then pushed through the sensor and the speedometer cable reassembled.

Generally speaking, the best position for the speedometer sensor is close to the firewall in the engine compartment.

The installation procedure is as follows:

- Mark the appropriate position with white chalk, then remove the speedometer cable from the vehicle;
- Remove the retaining circlip and withdraw the inner cable;
- Using a hacksaw, cut out and discard a 15mm section of the outer sheath at the marked position;
- Push the inner cable through the sensor and refit the two sheath sections by clamping the ends in the slotted end tubes. Note that the inner cable should



be a force fit into the sensor, otherwise the slotted disc inside the sensor will not rotate;

- Check that the inner cable is free to rotate, then re-install the speedometer cable in the vehicle.

When wiring the speedometer cable sensor, the colour coding for the wires is: Brown +8.2V; Green/Yellow signal; Blue ground.

The PCB itself is best installed under the dashboard of the car. Alternatively, the PCB may be mounted in a plastic case and installed towards the top of one of the front kick panels.

Once construction has been completed and the unit has been fitted to the car, you should enlist the help of a friend, either as driver or passenger, to set the trimpot.

Get the car moving at a constant speed of say 60km/hr (or any other that may be required) and then set the trimpot so that the buzzer just begins to sound. Now drop the speed back a little and make sure that the buzzer stops. Accelerating up to or just over the preset speed should cause the alarm to sound.

The same procedure is used to set the second pot, although here the driver can do it while driving along.

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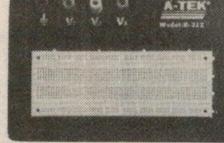
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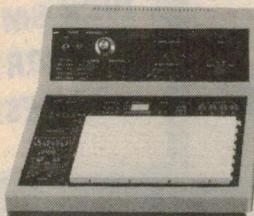
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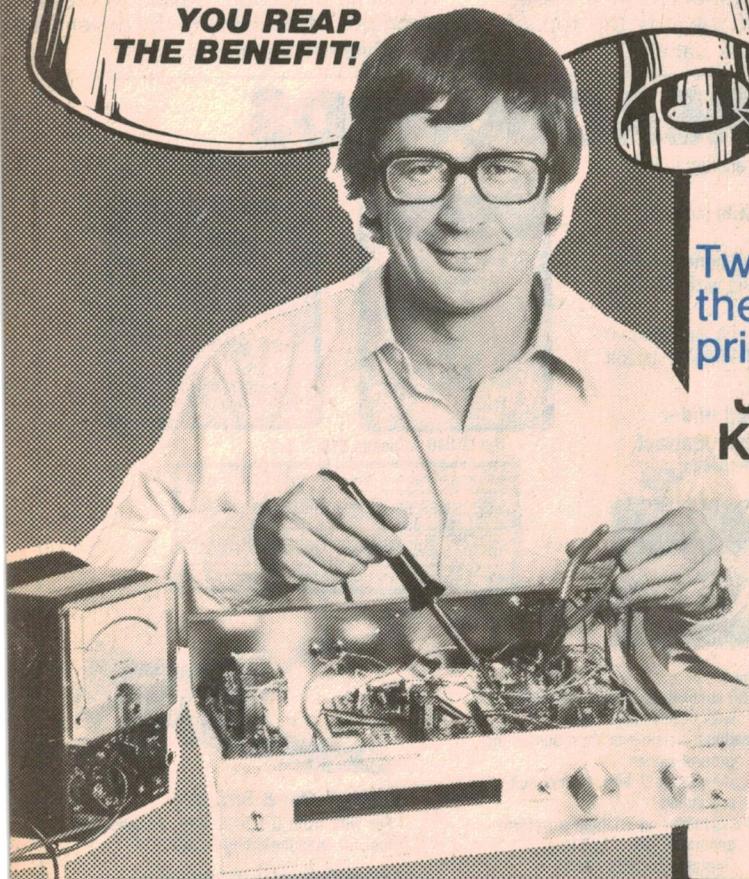
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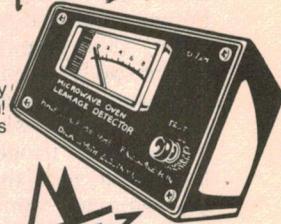
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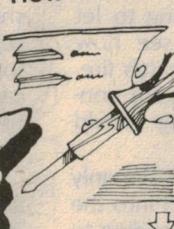
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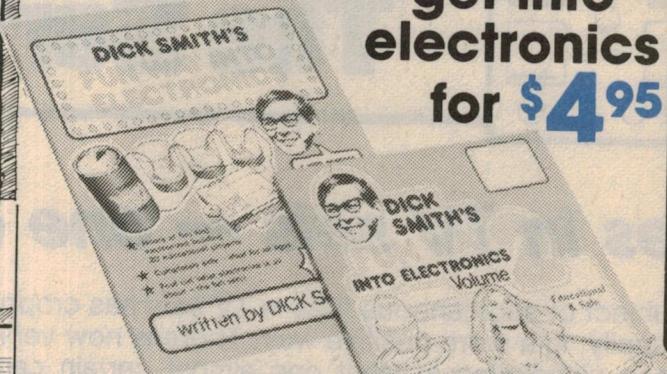
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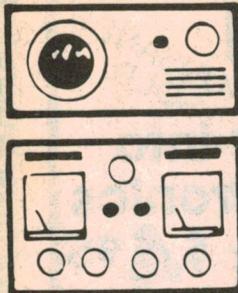
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The Serviceman

Fires in TV sets — one certain cause

The subject of spontaneous fires in TV sets has cropped up again but, happily, in a more positive way. There is now very convincing evidence pinpointing at least one almost certain cause of such outbreaks, and which may lead to similar causes being revealed.

The evidence concerning the fire problem comes from one of my regular contributors, Mr J.L. of Tasmania. His story is really a follow-up of one concerning a mystery fire, which he sent to "EA" some months ago and which was featured in "Forum". I am making it the main story this month because I felt that as many people as possible should be alerted to the problem. This is how J.L. tells it:

In the September 1982 edition of *Electronics Australia*, Forum ran my story describing a TV fire, or at least its aftermath. Now I can describe the "foremath" of a TV fire and clear up a lot of mystery surrounding these events. I have saved the evidence and forward it herewith.

(The "evidence" is illustrated in the accompanying photographs. Serviceman.)

I was called to service a Blaupunkt colour TV set which was showing a green picture. It seemed that the fault normally appeared about half an hour after the set was switched on, so the customer had switched it on sometime before I was due. The picture was well and truly green when I arrived, so I lost no time in getting the back off to measure the collector voltage on the green output transistor. The voltage was sky high and the transistor was obviously shorted.

FAINT BLUE GLOW

I reached around the front of the set to turn it off and, as the switch clicked over, I saw a faint blue glow appear on the body of the switch. I switched on again and the glow disappeared; switch off and the glow was back.

Closer examination showed that the glow was coming from an arc across one set of terminals on the power switch body. The arc was about 3mm long and appeared to be right inside the switch body material. I let it run for a couple of minutes and there was no change in its appearance.

At this point I should mention that the set appeared to be switched off; there was no sound and no picture. Presumably the standby current for the picture tube heater was enough to maintain the arc. The arc made only the faintest hiss and would have been quite undetectable outside the cabinet. As far as anyone would have been aware the set was off and totally inactive.

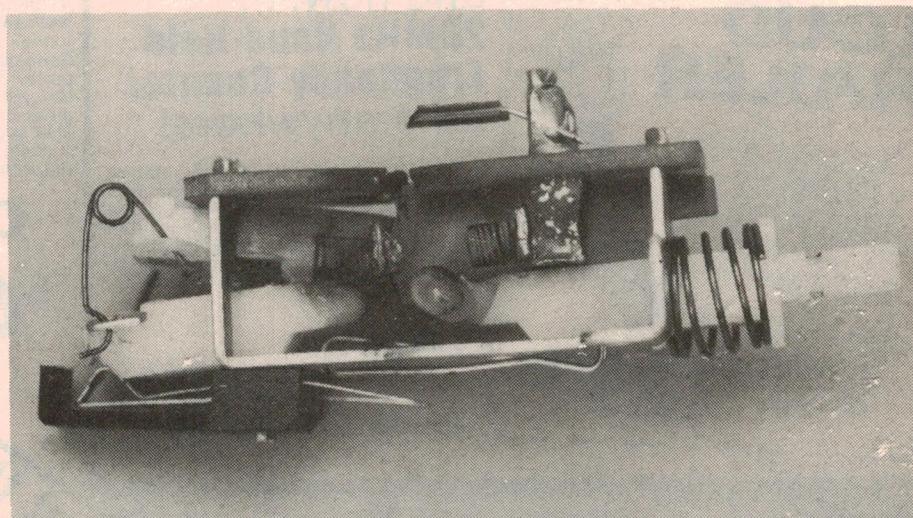
It would have been interesting to let the fireworks continue, and see how long it would take the set to catch fire. But by now the owner was quite concerned and felt that something should be done to stop the display.

Before pulling the plug — now the only course open to me — I reached into the cabinet and moved the wires leading to the back of the control panel. There was a bright blue "flame" as the AC wires parted from the switch — and the owner and I collided as we dived for the power point.

Up to this point I had not studied the switch very closely but once I had removed it from the set I realised that it was the same brand and type as fitted to the Kriesler set described in the September 1982 Forum article. It is also fitted to the Philips K9 and K11 series, and now I had found it in a Blaupunkt. How many more brands will it show up in?

Getting a replacement switch presented a problem. My source of Blaupunkt spares is in Melbourne, several days away, and the customer wanted his set that night. A possible solution was an old Blaupunkt set in the shop, the switch from which might be suitable. However, when I examined it I found that it was well on the way to the same fate. All I could do was order a new switch; the customer would have to wait.

Careful study of the second switch showed two of the contacts quite loose in the phenolic body of the switch. Presumably the reduced contact pressure and higher contact resistance resulting from this had heated the contacts to the point where the solder attaching the leads to the switch had



Potential fire hazard! — the plastic activating lever of the switch had melted in half while the rest of the switch shows severe damage due to arcing.



Note the damage to the phenolic switch body around the two missing contacts.

melted. All four joints were "dry".

As I write I have another Blaupunkt on the bench and it, too, has a loose contact in its power switch, with the first signs of dry joints on the leads. Significantly, it is the joints to the thin wires leading to the power supply that fail first. They cannot sink as much heat as the thicker multi-strand wire from the power plug.

Referring to the September 1982 Forum article, I would now make a significant change to the scenario I described then. I then blamed stray wires, dust, moisture, and loose contacts. I would now exonerate the first three items. The blame appears to lie entirely with the design of the switch and the loose contacts which develop as a result of the design.

If the TV subject of this article had not shorted its green output transistor, the owner would never have known of the faulty switch — until his house burned down. I was lucky to be able to witness the start of the conflagration and to stop it before much damage was done.

Well, that's J.L.'s story, and I feel that we should all take it very seriously. At the very least, all the sets mentioned should be checked for potentially faulty switches, as a matter of routine, whenever they are serviced for any other fault. And, naturally, if you recognise this switch as being used in any other brands or models, these should be treated similarly.

At the time of writing I have passed this story on to various colleagues, but I have not had time or opportunity to investigate other likely brands. However, the comments from some of these colleagues suggest that this particular type of switch may not have been fitted to all batches of the models which J.L. quotes. So, if you encounter this apparent contradiction, don't write off that particular brand or model. Keep checking.

Another point to note is that the problem appears to be aggravated in those sets, like the Blaupunkt, which feature a



This view clearly shows the damage to the switch contacts.

partially energised picture tube heater for "instant switch-on". I suggest that any set with this feature be given a routine power switch check whenever encountered.

In previous stories about fires in TV sets, particularly those in the newspapers, various authorities, such as firemen, have been quoted as advising people not to rely on the set's own power switch, because this "allows power to build up inside the set." They go on to advise switching the set off at the power point for maximum safety.

Somewhat ironically, this appears to be a case of giving the right advice for the wrong reason; switching off at the power point is always a wise precaution, even if the "power build-up" theory has little credence at a technical level.

FROM MY OWN BENCH

The main story from my own bench this month concerns a Rank Arena 2603; a set I have not had a great deal to do with until now. In most respects, it is very similar to the 2601 and, in fact, uses many of the same boards. However, there are differences and one of these set me back somewhat in trying to track down the trouble.

The set, as I encountered it in the customer's home, was completely dead; no sound, no picture. I pulled the back off and made a few preliminary checks,

Software for the Super-80 Computer

The programs are:

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Another poker machine game, but this one has graphics. For the budget conscious, you can set an upper limit on your stake.

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For those south of the border we present a program to select numbers for Tattslotto entries. Good luck.

Note: this book is exclusive to, and available only from, Electronics Australia, 57 Regent St, Chippendale 2008, PRICE: \$4 or by mail order from Electronics Australia, PO Box 163, Chippendale, NSW 2008. PRICE: \$5.

from which the main point that emerged was that the main HT rail, which I expected to be around 120V, was up to 145V.

At this point I decided that the job would be better done on my own bench. Not only was I less familiar with the set than others in this brand, but I was worried that the fault, whatever it was, might be potentially damaging if the set was run for any length of time. I wanted to know a little more about it before letting it run continuously while I prodded and probed. Also, it so happened that the customer had another set and wasn't worried if I took some time over the job.

As I fished out the circuit one difference immediately caught my eye, although it did not have a great deal to do with this story. It concerned the all-important 19V rail, which I noted was once again regulated. The original 2201, from which the 2601 was derived, featured a regulated 19V rail, but the 2601 did not. Later, it seemed the designers had second thoughts and decided that the 26in version deserved a better deal and fitted a regulator. Just how important it all is in practice I'm not sure.

AUXILIARY BOARD

A more important addition, as far as this story goes, is a small auxiliary board, PWC 256, designated "HV Protector". This consists of a couple of transistors, TR2001 and 2002, a couple of zener diodes, a normal diode, and resistors and electrolytic capacitors. It is mounted at the front of the chassis, under the picture tube, and connects to the "Deflection Out" board, PWC 433, via a plug and socket arrangement.

With the set on the bench I switched it on again and made a few more tests, the most important one being to determine if the line output stage was working. It wasn't and, having established this, I felt a good deal happier about letting the set run. I also realised that most of the set would be shut down in these circumstances; the aforementioned 19V rail, which powers several sections, is derived from the line output transformer.

My next check was the regulator transistor in the main power supply, TR691, (2SC1114). These have been known to go short circuit, which can send the supply rail up, as in this case, and this might conceivably trigger the HV Protector circuit and shut the rest of the set down. In fact, it proved to be quite OK, so that squashed that theory.

Next, I stoked up the CRO and made for the deflection board, PWC 367, and

more particularly the horizontal oscillator, TR501, and the horizontal pre-driver, TR502. The scope confirmed what I suspected; the horizontal oscillator was not working.

The obvious next step was a voltage check around the oscillator stage and this revealed a very good reason why the stage was dead. This stage runs from a 13.5V rail derived from the 120V rail and a $3.3k\Omega$ resistor (R551) on the "Deflection Out" board (PWC 433) and a zener diode (D505) on the "Deflection" board (OWC 367), but the best it could manage was about 2V.

Thus began the job of tracing out the circuit, via the numerous plugs, sockets, copper patterns, etc in an effort to determine just where the missing voltage was going astray. At first I suspected that some kind of breakdown on the deflection board might be loading the 13.5V rail, but a few measurements with the interconnecting plugs removed seemed to squash this idea.

Tracing the circuit back towards the 120V rail on the deflection out board, I suddenly realised that the extra HV Protector board, which I mentioned previously, was now interposed in this circuit, though I wouldn't attempt to even guess how this board is supposed to function.

But a few measurements made me suspect that all might not be well on this board so, not without some difficulty, I managed to get it out from under the picture tube, disconnect it from its cable, and get it on the bench for a closer look. There were no obvious signs of anything wrong, and a few preliminary measurements of resistors, diodes, etc also revealed nothing.

But what about the transistors? On an impulse I pulled out TR2001 (2SA539) and tested it. And for once I had picked it first time; it was a dead short from collector to emitter. I also checked the second one, TR2002 (2SC945), but it was intact. I replaced the faulty transistor, reconnected the board, and prepared to switch on.

But I hesitated at the last minute. I was still worried about the excessive voltage I had observed on the 120V rail. Was this what had taken out the transistor on the protector board? And had this board been trying to shut the set down to prevent further damage? More importantly, was I risking further damage if the short circuited transistor was only a symptom of a more serious fault?

With these thoughts in mind I decided to play safe. I fished out the Variac, and wound it down to do what I calculated would bring the 120V volt rail down from 145V to its correct value. I reason-

ed that this should provide at least a measure of protection if there was still a fault.

Finally I switched on. And was there a fault! I don't know to what extent my precautions may have been useful, but the tripler turned on a display like a thunderstorm; sparks and flashes all over the place. I switched off hurriedly, but not soon enough to save the transistor I had just fitted to the protector board.

But that was only a minor problem. My real concern was for the tripler. Tripplers are expensive and, sometimes, in short supply. As it happened I had a spare, but I did wonder whether I could salvage the old one. I pulled it out and examined it carefully, finding a number of fine cracks in the case, but without being able to determine what form the breakdown had taken.

I decided it was worth a try to save the tripler, so I cleaned out and around the cracks and then filled them with a silicone sealant which has proved successful in other, more clear cut, cases. I left it to cure and, in the meantime, fitted another transistor on the protector board. Finally, when the curing time had expired, I tried again, with the Variac wound down even further.

Unfortunately, it didn't work. Granted the sparking was much less intense, and the transistor on the protector board survived, but it was clear that the tripler had had it. So I fitted the new tripler and, with the Variac still in circuit, tried a third time. Not surprisingly, everything held this time and, as I wound the Variac up to the full mains voltage, the 120V rail settled at 119.65V — according to my new digital meter.

I let it run on the bench for a day or so, carried out the usual routine adjustment procedure, then returned it to the customer. I don't anticipate any further problems, although I'd like to know more about that protector board in case I encounter more serious faults in the future.

MORE ON FUSES

And, to finish off, here is a letter just to hand from a professional serviceman, Mr D.R. of The Entrance, NSW. He offers a possible explanation for the fuse and degauss problems which I related in the August issue. He writes:

Dear Fellow Sufferer: Re the August article on fuses in the National set. The symbol 'T' always indicates time delay on Japanese chassis. Standard fuses would be marked "2A", not "2AT".

We run into this type of problem a lot, with customers buying wrong fuses.

I always enjoy the column. Best regards.

Well, that appears to be a piece of very vital information which I confess escaped me. Thank you, D.R., and I hope your comment will help other readers. ☺

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Frequency doubler uses one comparator

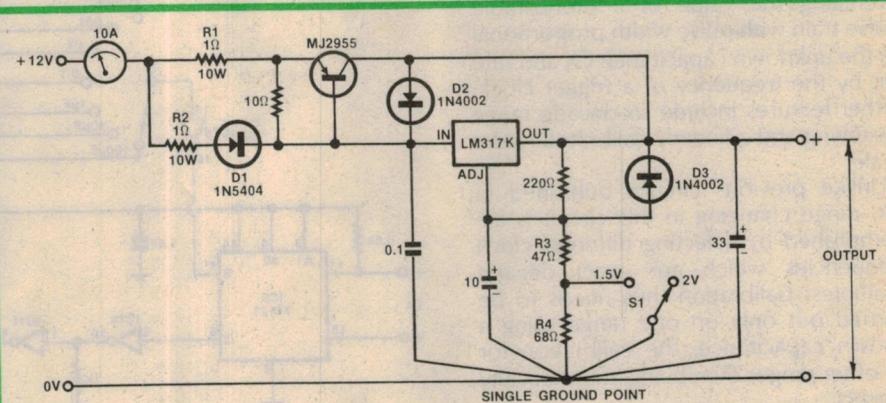
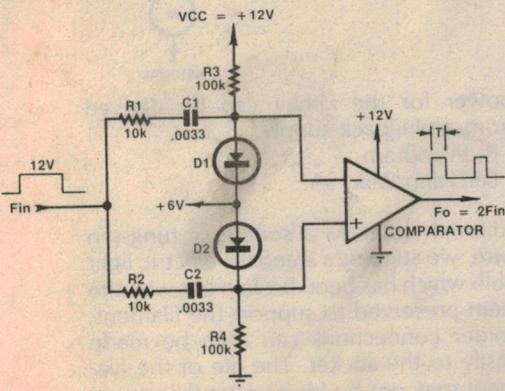
Based on a single comparator IC, this simple circuit produces rectangular pulses at twice the input signal frequency. It does this by producing a positive output pulse of duration T on both the rising and falling edges of a square wave input signal.

Here's how it works: On the rising edge of the waveform, D1 is forward biased and D2 is reverse biased. Consequently, the non-inverting input will be at V_{cc} while the inverting input will be at $0.5V_{cc} + 0.6V$. The output of the comparator thus switches high, and remains in that state until C_2 charges to the level where the voltage on the non-inverting terminal falls below the voltage on the inverting terminal. The output of the comparator then switches low again.

Similarly, on the falling edge of the input waveform, the inverting input of IC1 is grounded (D1 reverse biased) while the non-inverting input is set to $0.5V_{cc} - 0.6V$ (D2 forward biased). The output of the comparator thus switches high again and remains in this state until C_1 charges.

The duration of the output pulse (T) is adjustable for both the rising and falling edges of the input waveform. It is given by $K(R_1 + R_3)C_1$ for the falling edge and $K(R_2 + R_4)C_2$ for the rising edge, where K is a constant that is dependent on V_{cc} and the input voltage. In the example shown, both sections of the circuit are identical and the period T is about 0.31ms.

From "Electronics", May, 1983.



Glow plug driver for model aeroplanes

This glow plug driver circuit was developed as a result of dissatisfaction with existing circuits or devices. It has a regulated output voltage switchable between 1.5 and 2V, is short-circuit protected, thermal overload protected, and output current limited.

Diode D1 is used to keep the voltage across resistors R1 and R2 approximately equal. The maximum current through R2 is approximately equal to the maximum current through the LM317K. This is approximately 2.5A but varies between brands; some will pass only 1.5A. In the above design the current through R1 and R2 is approximately equal so the maximum output current is about twice the maximum current of the LM317K.

The LM317K and the MJ2955 are mounted on a common heatsink (Dick Smith cat No. H-6704) as close together as possible. This allows

excessive heat in the MU2955 to activate the thermal overload circuitry in the LM317K. Both devices must be mounted with thermal grease, insulating washers, and plastic insulator caps.

To check the maximum output current short the output briefly and read the meter. Between five and six amps is sufficient to drive a glow plug. If the reading is less than 5A the value of R1 must be reduced by connecting resistors in parallel with it.

The resistive divider in the output circuit gives 2V with switch S1 open and 1.5V with it closed. Heavy flexible cable is needed to connect to the glow plug to minimise losses. Twin 4mm auto cable, about 1.2m long is adequate. The input should use similar wire.

An alternative, and more economical, regulator is the LM317T. This could be bolted to the heatsink underneath the MJ2955. Resistor R1 would be 0.47Ω and R2 1.5Ω .

I.R.B. Lovi,
Moranbah, Q.

IC sockets and double sided boards

A problem with IC sockets — as distinct from ICs themselves — is that they are not designed for soldering to double sided boards. The following solution to this problem is both simple and effective.

First, when preparing the board, drill the IC pin holes slightly oversize. Then thread a fine gauge wire, such as tinned fuse wire, through each hole, bend one end over, and secure

it to the copper pattern with a dab of solder.

Cut the wire on the other side of board and secure that end similarly, taking care that the solder does not flow over the hole. Do this for each hole, then insert the socket all pins securely.

If carefully done the result is as effective as plated-through holes, but does not require any special equipment.

H. Nacinovich,
Gulgong, NSW.

Circuit & Design Ideas

continued from page 69

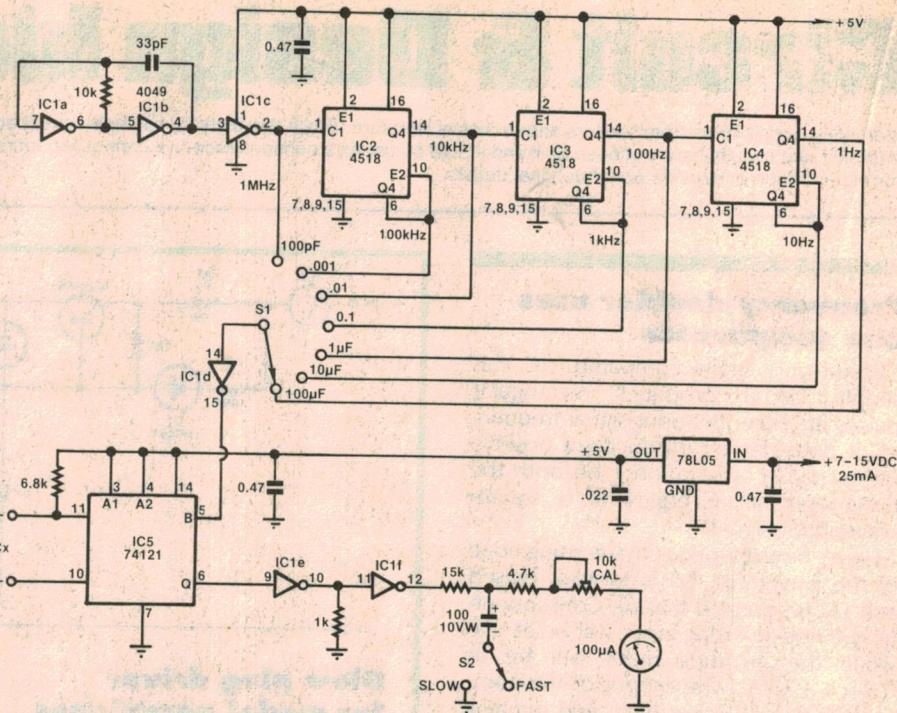
Wide range capacitance meter

Need a low-cost capacitance meter that covers the range 4pF to 100 μ F with high accuracy? This unit functions by averaging the value of a monostable pulse train with pulse width proportional to the unknown capacitance C_x and rate set by the frequency of a trigger clock. Other features include six-decade range switching and a linearly calibrated meter scale.

Unlike previous circuits published in EA, range changing in this circuit is accomplished by selecting different clock frequencies which are exact decade multiples. Calibration thus needs to be carried out only on one range using a known capacitance, the calibration for all other ranges then being automatically correct.

Gates, IC1a and IC1b form a 1MHz oscillator whose output is buffered by a IC1c. From there, the signal is fed to three CD4518 CMOS dual decade dividers (IC2,3&4) while range switch S1 selects one of the seven available clock frequencies from 1MHz to 1Hz. The selected clock signal is then buffered by IC1d and fed to the trigger input of IC5.

IC5 is a TTL SN74121 monostable whose pulse width is set by the unknown capacitor C_x connected to pins 10 and 11. The monostable output pulse



train is taken from pin 6 and buffered by IC1e and IC1f to produce defined output logic levels of 0V and 5V. Finally, the signal is fed to an averaging network and then applied to a 100 μ A FSD meter via a 10k Ω calibration trimpot.

The meter inertia provides sufficient smoothing on most ranges to provide stable readings, but additional filtering on the 10 μ F and 100 μ F ranges is

necessary. This function is performed by the 100 μ F capacitor. Switch S2 switches out the capacitor on the lower ranges to avoid a slow response time or problems due to leakage current.

Construction is straightforward but take care to minimise stray capacitance to IC1e and IC1f.

G. Watt,
Como, NSW.

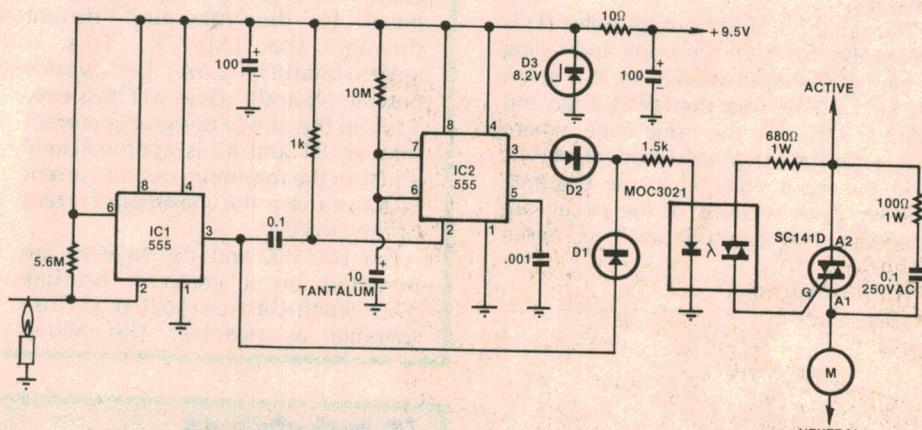
Flame detector circuit controls booster fans

Most gas space heaters are equipped with booster fans that operate continuously. The problem is that the booster fan in some designs can be quite noisy or can become noisy with age. This flame detection circuit alleviates the problem by turning the fan on only when it is required – ie, when the main heater flame is on.

Here's how it works. IC1 is a 555 timer IC used here as a comparator. When the main flame is on, pin 2 of IC1 is pulled low and thus its pin 3 output is high. This, in turn, triggers the SC141D Triac via a MOC3021 optocoupler and so the fan motor runs for as long as the flame is present.

IC2 is a 555 monostable delay circuit that keeps the fan running for 132 seconds after the main flame has gone out. When the heater thermostat cuts off the flame, pin 3 of IC1 goes low and triggers IC2 via a 0.1 μ F capacitor. Pin 3 of IC2 is high during the monostable period and thus the fan will continue to run during this time.

After about 132 seconds, the 10 μ F tim-



ing capacitor of IC2 reaches 2/3Vcc and the pin 3 output goes low. The fan motor now turns off and remains off until the heater thermostat turns on the heater flame once again. Diodes D1 and D2 form a simple OR gate to isolate the outputs of the two 555 timers from each other.

Construction of the circuit is straightforward, but take care with the mains wiring to the Triac and the fan motor. A piece of tungsten wire should be used for the flame detector, while

power for the circuit can be derived from a plugpack supply.

R. Wundram,
Ferryden Park, SA.

Editorial Note: As a source of tungsten wire, we suggest a standard electric light bulb which has been broken but with the stem preserved to support the filament. Solder connections can then be made easily to the socket. The life of the filament may not be long under these conditions because it is exposed to air.

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Despite its relative circuit complexity, construction of the new UHF transceiver is quite straightforward. Most of the components are mounted on a printed circuit board (PCB) measuring 162 x 199mm and coded with the Dick Smith type number ZA1510. Two further PCBs, which form the front and rear panels, are soldered at right angles to this main board and the whole assembly fitted into a rugged ABS plastic case.

Both the front and rear panels are supplied with silk-screen lettering featuring white lines on a black background (see last month's front cover). Combine these with an attractive set of matching knobs and a backlit S-meter, and the result is a really professional looking unit that gives little away to expensive commercial equipment.

In designing the new UHF transceiver, Dick Smith Electronics were determined that the job of construction should be made as easy as possible. To this end, all purchasers of the kit receive a detailed instruction manual which describes construction on a step-by-step basis. The parts layout diagram comes complete with a grid pattern and you simply insert each part in turn at the grid location indicated and cross it off the parts list.

In fact, it is almost impossible to make a mistake during construction if the manual is carefully followed. In addition to the usual parts layout and wiring diagrams, the manual includes numerous photographs and diagrams showing every conceivable aspect of construction. It even gives the colour code for each resistor!

As a further aid to constructors, the top of the main PCB is screen-printed with the parts overlay while the underside has a blue solder mask to help prevent

BUILD THIS: 40-channel UHF amateur transceiver

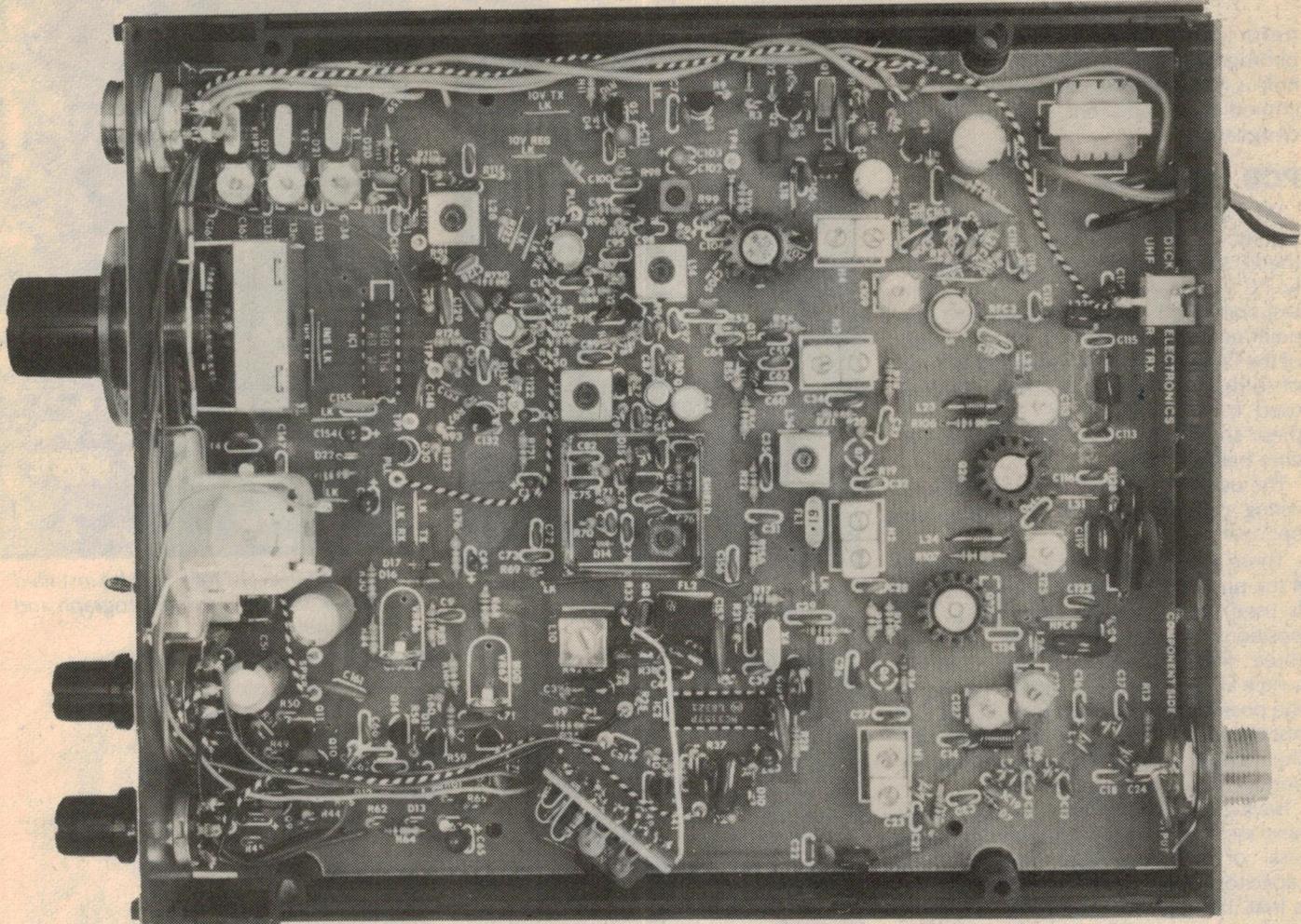
by GREG SWAIN

PART 2

Last month, we introduced the Explorer 1 UHF amateur transceiver and detailed its circuit operation. This month, we cover construction. Alignment details and the optional S-meter circuitry will follow in November.

inadvertent solder bridges. Even so, many of the copper lands are quite close together so care is required when soldering in the various components. A fine-tipped iron with a rating of 15-30W is essential for the job, although a slightly larger iron may be required for soldering the front and rear panels to the PCB.

Constructors should note that a few minor corrections have been made to the parts layout diagram since the initial PCB production run. In particular, a few component labels were missing from the original parts overlay, a situation which has since been corrected. The parts overlay diagram shown with this article is



-SPECIAL NOTE

Readers should note that it is illegal to operate transmitting equipment on the amateur bands without an amateur radio licence.

correct and should be referred to if there is any doubt.

Board preparation

Before actually mounting any of the components, a certain amount of work on the PCB is necessary. The first job is to remove a 3mm strip of solder mask from the earth pattern at either end of the PCB. This is best done by masking off each 3mm strip with masking tape and then removing the solder mask using a cotton bud dipped in nail polish remover.

Alternatively, the solder mask can be scraped off using a sharp utility knife.

A fault that is common to all PCBs in the initial production run is that the solder mask runs right up to the edge of one of the mounting holes for capacitor C34 (adjacent to helical resonator H3). Constructors should therefore scrape

CHANNEL FREQUENCIES

Switch position	Frequency	Switch position	Frequency
1	438.025	21	438.525
2	438.050	22	438.550
3	438.075	23	438.575
4	438.100	24	438.600
5	438.125	25	438.625
6	438.150	26	438.650
7	438.175	27	438.675
8	438.200	28	438.700
9	438.225	29	438.725
10	438.250	30	438.750
11	438.275	31	438.775
12	438.300	32	438.800
13	438.325	33	438.825
14	438.350	34	438.850
15	438.375	35	438.875
16	438.400	36	438.900
17	438.425	37	438.925
18	438.450	38	438.950
19	438.475	39	438.975
20	438.500	40	439.000

away the solder mask from around the hole to provide a suitable solder land.

It is also necessary to enlarge the mounting hole for transistor Q27 to

$\frac{1}{8}$ -inch. This transistor is actually mounted on the underside of the PCB and secured by a $\frac{1}{8}$ -inch screw which screws into a brass stud on the compo-

40-channel UHF transceiver

next side of the board (see photographs). The relevant mounting hole is located in the middle of the circle immediately adjacent to the Q27 designation.

PCB assembly

We are now ready to commence assembly of the PCB. Begin by installing the PC stakes and the wire links. Basically, PC stakes are required at each of the test points TP1-TP4, at the unmarked test point adjacent to L28, and at both ends of the PCB where you removed the strips of solder mask. Four PC stakes are also used to support the VCO shield but these should be left off the PCB for the time being.

The use of PCB stakes for the external wiring connections can be considered optional.

There are 17 wire links on the PCB (16 if the optional 10.7MHz crystal filter FL1a is used) and these are installed at the positions marked "LK". Note that the three links adjacent to the channel switch should all be insulated to prevent the possibility of short circuits. If you are not using the optional crystal filter (FL1a), then install a wire link in this position between the two outside holes.

Having installed all the wire links, the next step is to begin the rather tedious task of installing the resistors and capacitors. The main point to note here is that, because we are dealing with RF, all component leads should be as short as possible. Install the resistors end on only when there is insufficient space to mount them flat against the PCB.

Resistor R111 acts as a coil former for L27, so this coil must be wound before the resistor is inserted. Layer-wind 24 turns of 33 B&S enamelled copper wire onto the resistor body, clean the enamel from the ends of the winding, and solder the ends to the resistor leads immediately adjacent to the resistor body. The resistor can then be inserted end-on in the normal fashion.

Little comment is called for with regard to mounting the capacitors except to point out that you must use the capacitor type designated. Do not interchange greencaps for ceramics or tantalums for normal electrolytics. When mounting the trimmer capacitors, make sure that the red dot on the side of the trimmer is mounted away from the earth pattern. The exception here is trimmer C126 which should be mounted with its red dot towards diode D6.

Do not install capacitors C105 or C124 at this stage. These two capacitors are mounted on the copper side of the PCB and their installation will be covered later. Capacitor C36 (shown dotted on



This photo shows how transistor Q27 is installed. Note also Q6 and C124.



Capacitor C105 (100pF) must be installed exactly as shown in this photograph and in Fig. 4 below.

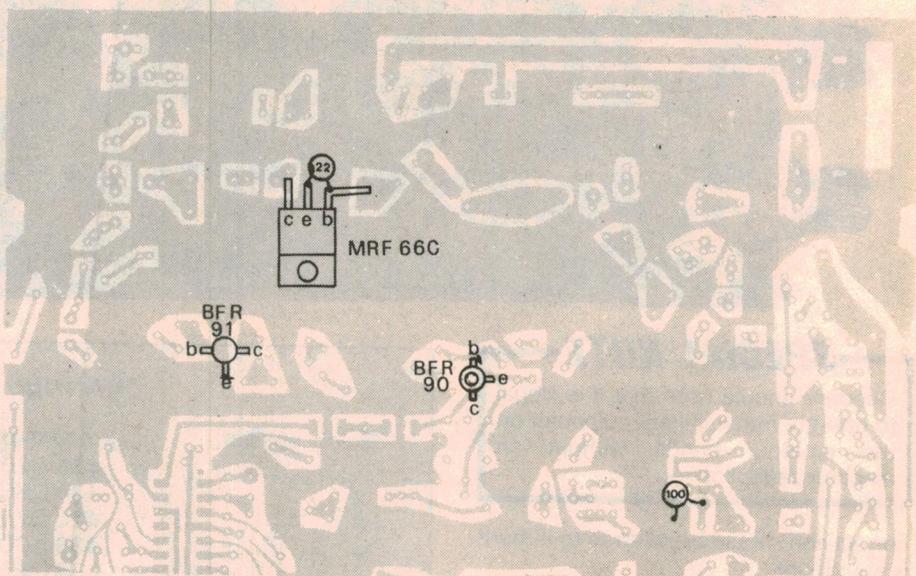


Fig. 4: Underboard component mounting details (Q6, Q7, Q27, C105, and C124).

the parts layout diagram) should be installed only if FL1a is also installed.

By now, the PCB will be beginning to take shape. Once you've got all the resistors and capacitors installed, most of the hard "yakka" is over. The rest is straightforward.

Semiconductors

The semiconductor complement consists of no less than 23 diodes, 30 transistors and two integrated circuits. Mount the diodes first, again keeping all component leads as short as possible. Diodes D2, D4, D9, D10, D11, D13, and D19 are mounted end on, while the remainder are mounted flat against the PCB in the conventional manner.

Pay particular attention when installing

diodes D6 and D7 (both BA244 types). The cathode end of these diodes is indicated by the red band, not by the two yellow bands which simply indicate the type number. (Red, yellow, yellow = 244. Get it!)

Care is also required when mounting the transistors to ensure correct lead orientation. Double check each transistor against the circuit diagram before soldering it into circuit. Transistors Q1, Q18, Q19 and the small signal plastic pack types should all be mounted so that the transistor bodies are 3.4mm above the surface of the PCB. In practice, this simply involves pushing the transistors down onto the PCB as far as they will comfortably go without placing undue strain on the leads.

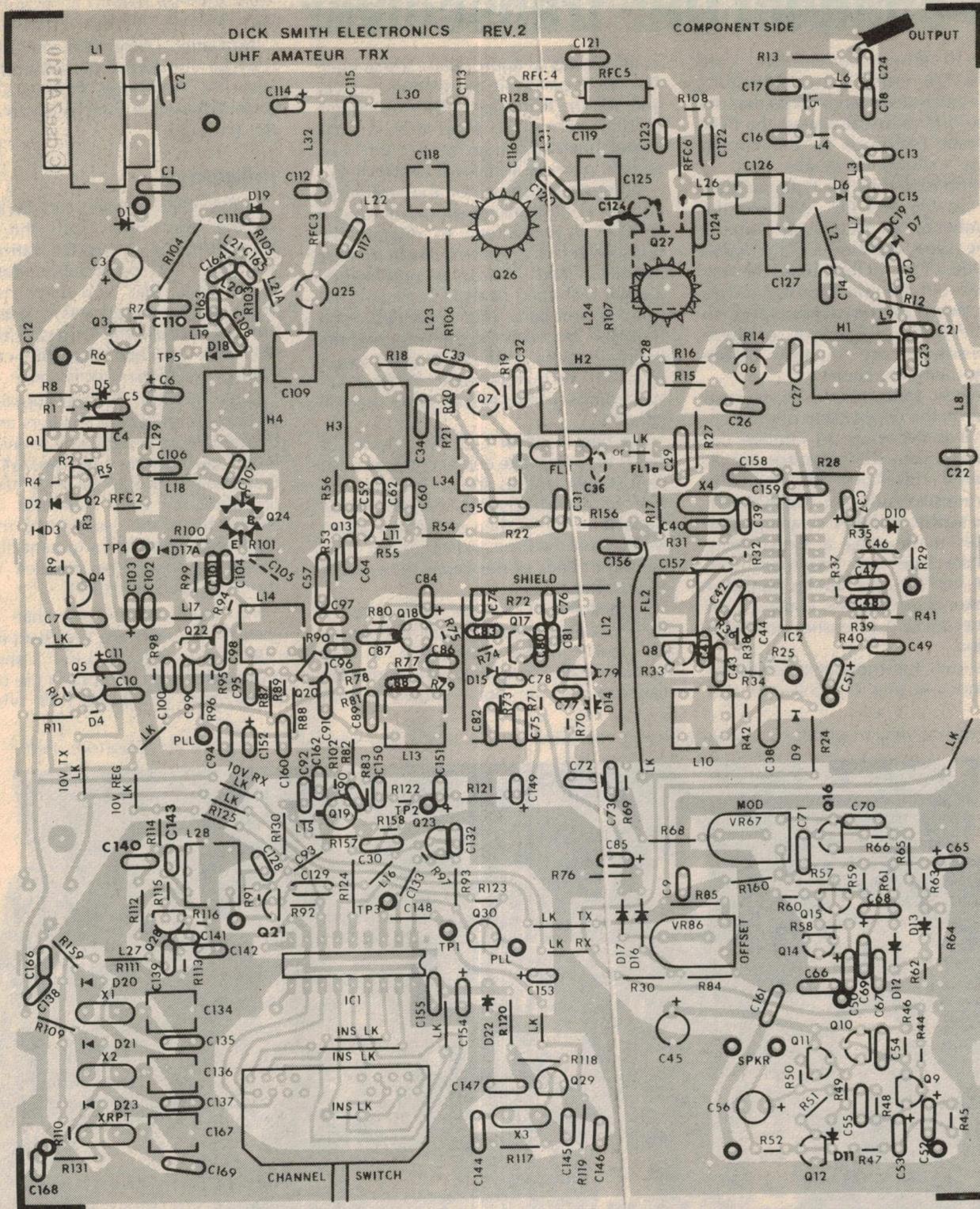


Fig. 3: parts location diagram for the main PCB. Mount the parts in the order indicated in the parts list

The TO-39 package transistors — Q24, Q25 and Q26 — are all mounted flat against the PCB. Note that four holes are drilled at the Q24 location, although only three are used in practice. This was originally done so that an alternative transistor (with a different lead configuration) could be substituted for the 2N3948, but Dick Smith Electronics ad-

vise that they will now only be supplying the latter. The three holes to be used at Q24 are designated e,b,c on the parts overlay, so there should be no confusion as to lead orientation.

The metal cases of Q25 and Q26 must be earthed and to this end you will find a hole in the earth pattern adjacent to each transistor. The earth connections

are made by means of short lengths of tinned copper wire inserted through the holes and soldered directly to the transistor cases. Note that small clip-on heatsinks are required for Q24 and Q26, but not for Q25.

RF transistors Q6 and Q7 are mounted on the copper side of the PCB and require careful reference to the circuit

40-channel UHF transceiver

diagram to ensure correct lead configuration. To install these transistors, bend the leads down and out so that the transistor bodies sit flat against the PCB, then solder the leads to the copper lands. Fig. 4 shows the details.

Do not be misled by the type numbers marked on Q6 and Q7. Whereas the type number for Q6 faces away from the PCB, the type number for Q7 faces towards the PCB – at least that's the way it worked out on the prototype. This may not always be the case however, so check the lead configuration of these two transistors very carefully before soldering them into circuit.

RF power transistor Q27 is also mounted on the copper side of the PCB, but first it is necessary to remove the solder mask from the transistor mounting position. This is best done by marking the transistor outline on the PCB with a suitable scribe, and then scraping away the solder mask using a sharp utility knife. Make sure that you thoroughly clean the contact area, as the transistor must make good thermal contact with the copper pattern to ensure adequate heatsinking.

Fig. 4 shows the mounting details for Q27. Bend and trim the collector and

emitter leads as appropriate, smear heatsink compound on the mating surfaces and bolt the transistor to the PCB using a machine screw and brass stud. A small clip-on heatsink is then fitted to the brass stud to provide additional heatsinking.

Although not shown on the prototype, additional heatsinking should be added to Q27 if you intend to operate the transceiver in the transmit mode for long periods of time. This can be provided by a small U-shaped heatsink bent up from scrap aluminium (not provided) and mounted between the transistor and the copper pattern on the PCB. Don't forget to smear all mating surfaces with heatsink compound to ensure good thermal contact.

The base lead of Q27 forms coil L25 and is bent to make contact with an adjacent solder land as shown in Fig. 4 and the accompanying photograph. Capacitor C124 is then connected directly between the base and emitter of Q27. Keep the leads of this capacitor as short as possible.

Capacitor C105 can also be installed at this stage, and must be mounted exactly as shown in the photograph. In particular, make sure that you earth the capacitor at the point shown (ignore

what the PCB overlay shows) and once again keep the leads as short as possible.

Installation of the semiconductors can now be completed by soldering in the two ICs. Note that there are several unused holes adjacent to pins 8 and 9 of IC1 (PLL02A).

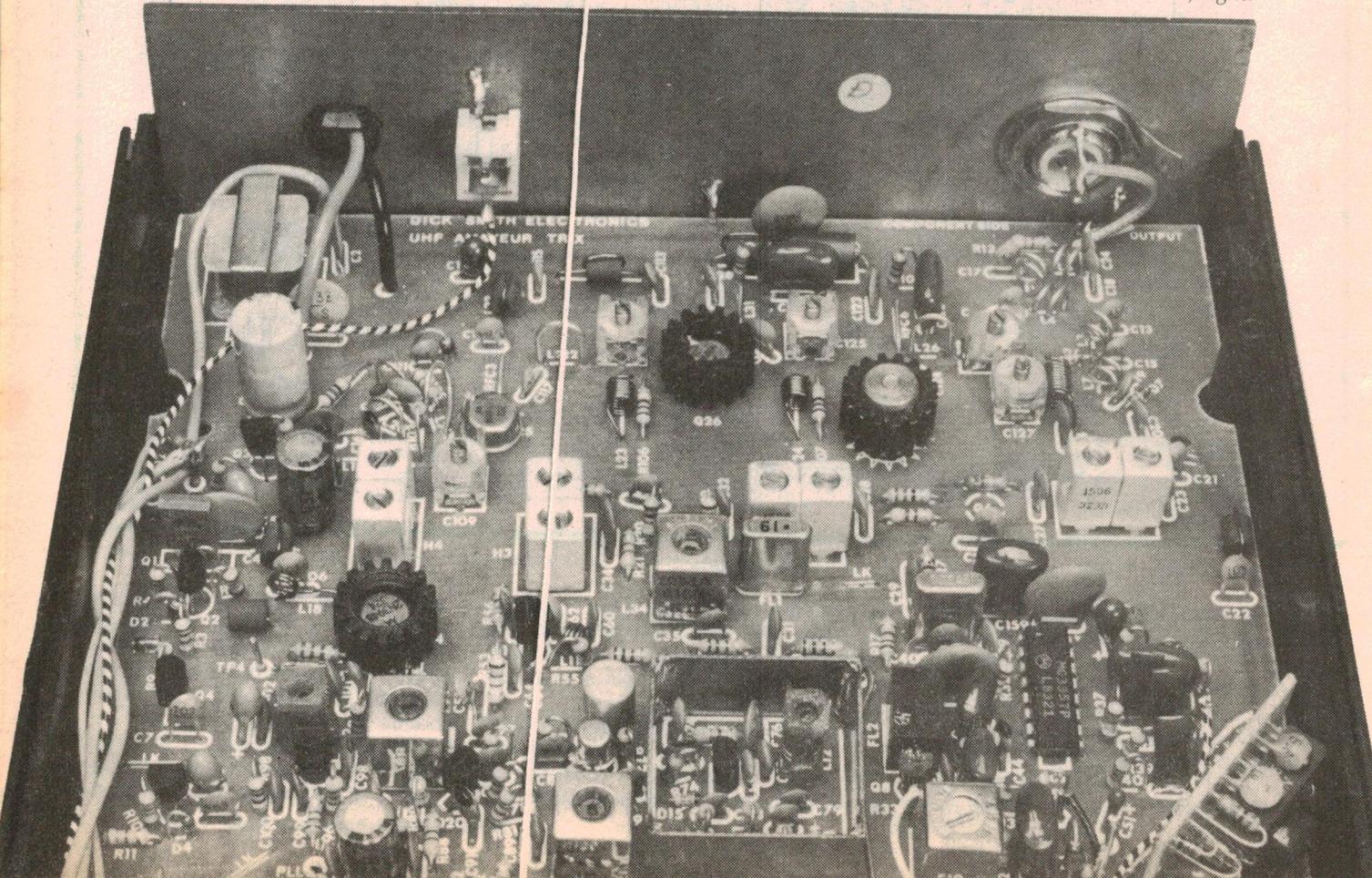
Inductors

At this point, you are ready to begin installing the coils and the helical resonators. Fig. 5 lists the various coils and gives the construction details for those coils that you have to wind yourself. The main points to watch here are that you use the correct wire gauge for each coil and that the coils are wound exactly to specification.

Coils L12 and L17 are supplied pre-wound on red plastic formers and must be mounted the right way round. If you look closely at the coils, you will notice that one side of the coil body has a long rib while the other side has a much shorter rib. In the case of L12, the short rib should be adjacent to capacitor C79, while L17 should be installed with its short rib adjacent to R94.

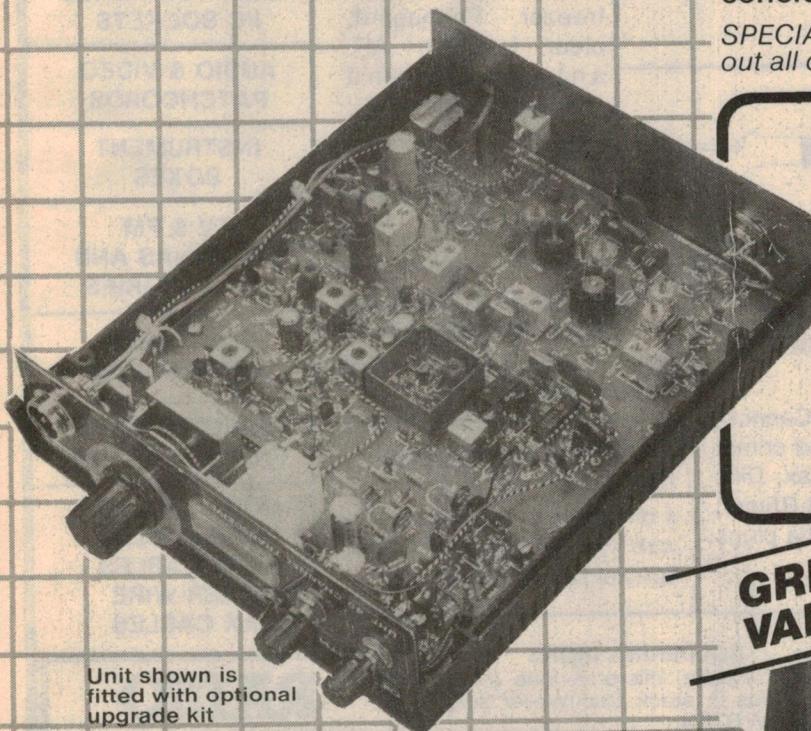
The only other coils that require special comment are the "hairpin" coils L19-L21, L22 and L26. L19-L21 should be mounted so that the tops of the coils are about 7mm above the PCB, while L22

Below: general view inside the transceiver looking towards the rear panel. The S-meter board is visible at bottom, right.

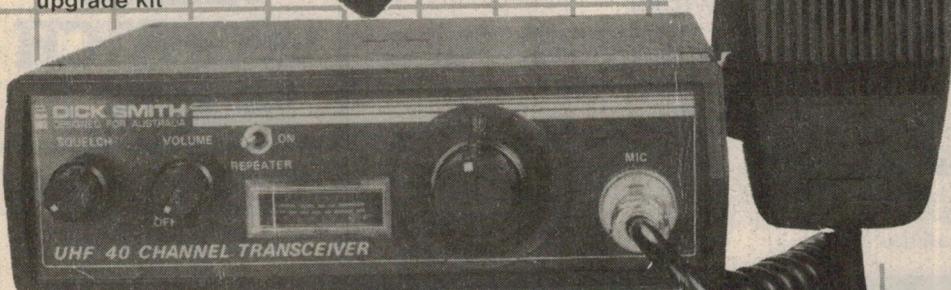


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See Page 98 for address details

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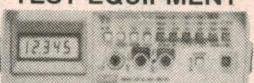
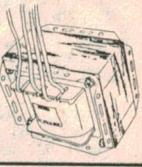
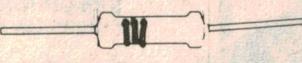
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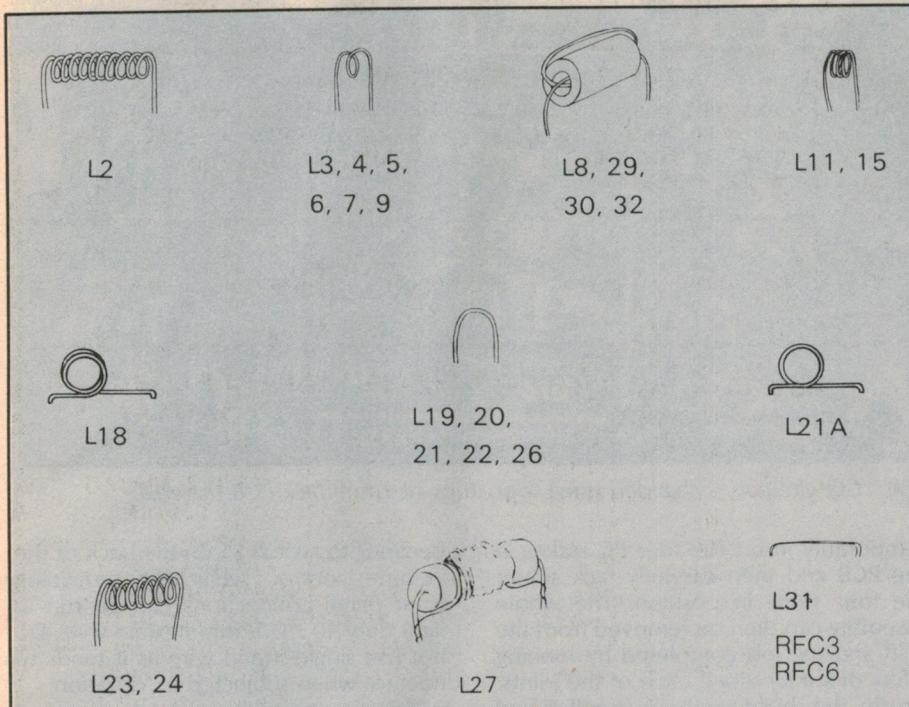
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40-channel UHF transceiver

and L26 should be the same height as the screwdriver slots on the adjacent trimmer capacitors C118 and C126. Note

also the special shape of L21A (see photograph and Fig. 5).

Assembly of the main PCB can now be



- | | | | |
|-----|---|------|--|
| L1 | DC choke | L21 | hairpin 20 B&S on 3/16-inch mandrel |
| L2 | 11T 25 B&S close wound on $\frac{1}{8}$ -inch mandrel | L21A | 1T 20 B&S on 3/16-inch mandrel (see Fig. 5) |
| L3 | 2T 20 B&S on $\frac{1}{8}$ -inch mandrel | L22 | hairpin 20 B&S on 3/16-inch mandrel |
| L4 | 2T 20 B&S on $\frac{1}{8}$ -inch mandrel | L23 | 8T 25 B&S close wound on $\frac{1}{8}$ -inch mandrel |
| L5 | 2T 20 B&S on $\frac{1}{8}$ -inch mandrel | L24 | 8T 25 B&S close wound on $\frac{1}{8}$ -inch mandrel |
| L6 | 2T 20 B&S on $\frac{1}{8}$ -inch mandrel | L25 | base lead on transistor Q27 (see text) |
| L7 | 2T 20 B&S on $\frac{1}{8}$ -inch mandrel | L26 | hairpin 20 B&S on 3/16-inch mandrel |
| L8 | 1T 25 B&S on ferrite bead | L27 | 24T 33 B&S wound on R111 |
| L9 | 2T 20 B&S on $\frac{1}{8}$ -inch mandrel | L28 | 150MHz coil 004 |
| L10 | 455kHz coil | L29 | 1T 25 B&S on ferrite bead |
| L11 | 4T 25 B&S close wound on $\frac{1}{8}$ -inch mandrel | L30 | 1T 25 B&S on ferrite bead |
| L12 | red coil (VCO) | L31 | 20 B&S wire link |
| L13 | 150MHz coil 004 | L32 | 1T 25 B&S on ferrite bead |
| L14 | 150MHz coil 004 | L34 | 10.7MHz transformer |
| L15 | 4T 25 B&S close wound on $\frac{1}{8}$ -inch mandrel | H1 | 1506 helical resonator |
| L16 | 10uH | H2 | 1506 helical resonator |
| L17 | red coil | H3 | 1506 helical resonator |
| L18 | 2T 25 B&S on $\frac{1}{8}$ -inch mandrel | H4 | 1506 helical resonator |
| L19 | hairpin 20 B&S on 3/16-inch mandrel | RFC2 | link 22SWG through ferrite bead |
| L20 | hairpin 20 B&S on 3/16-inch mandrel | RFC3 | 20 B&S wire link |
| | | RFC4 | 1T 25 B&S on ferrite bead |
| | | RFC5 | 6-hole ferrite choke, 23 B&S |
| | | RFC6 | 20 B&S wire link |

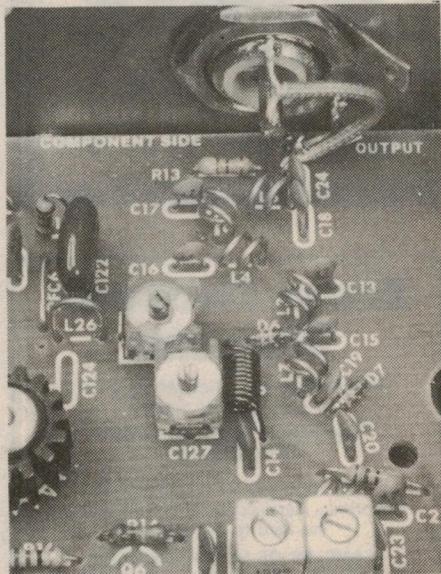
Fig. 5: Coil details. Note that there is no L33 in the above list. Windings specifying 25 B&S and 33 B&S use enamelled copper wire. All other windings **MUST** use tinned copper wire, not enamelled wire.

completed by installing the filters and crystals and, finally, the channel switch. As mentioned previously, FL1a and the repeater crystal XRPT are part of the optional upgrade pack. Do not forget to install C36 if you do elect to install FL1a.

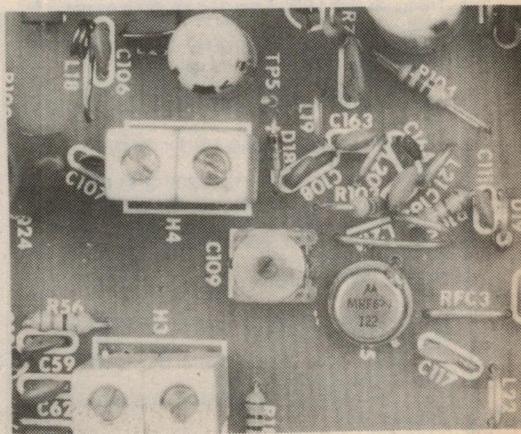
The channel switch mounting is a little tricky and requires care to ensure that all the leads pass through the PCB. Screw a lock nut onto the threaded switch shaft, then push the switch down onto the PCB as far as it will go and solder the end connectors first. The switch mounting can now be checked and adjusted as necessary before soldering the remaining pin connectors.

Finally, it is necessary to shield the VCO to prevent spurious radiation into adjacent circuitry. Supplied with each kit is a strip of 1mm-thick double-sided PCB material and this should be cut into four 28mm lengths using a sharp pair of scissors. The four PCB strips are then soldered to PC stakes at the corners of the VCO circuit (see photographs).

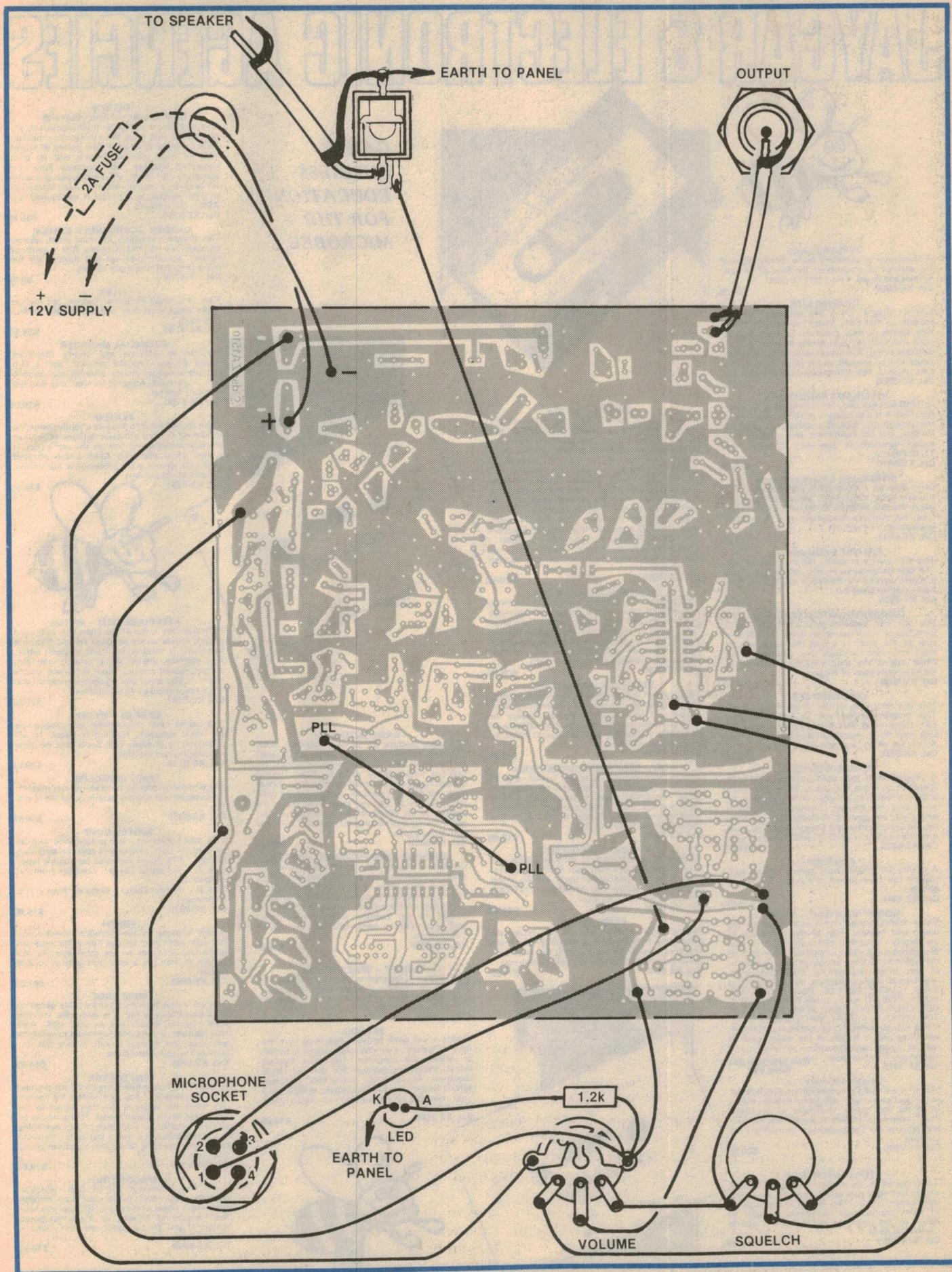
The best way to go about this job is to



Close-up view of the antenna filter coils. See text re diodes D6 and D7.



Detail shot showing how L18 on the PCB is mounted.



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You are a tank running around a maze gathering all the supplies you can. It sounds easy, but you have a guided missile hot on your trail. Your only defence is a remote controlled mine which you drop and explode at will. A very fast joystick or key controlled game.
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A low resolution graphic version of the popular game "Scrambler". You must defeat the rockets and bomb the radars in an effort to get to the next stage which is even harder. This game can be either controlled by a Joystick or by keys. Being in Lores graphics it is a very fast game. If you are bored with the same land pattern you can devise your own.
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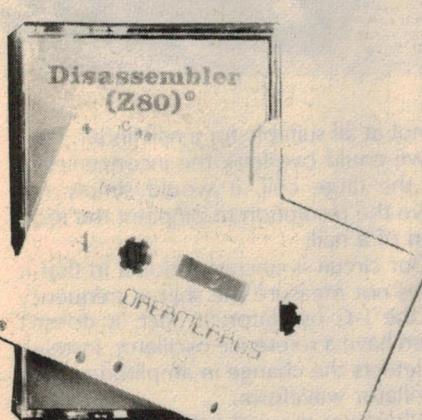
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Nail Finder: the electrician's mate

The nail finder is an essential tool for any home handyman. It will help locate timber studs behind Gyprock or plasterboard wall surfaces and also locate pipes buried in walls.

Actually this article arose as the result of a home renovation project carried out by one of our staff members. The said staff member had to put new skirting boards in a large room with Gyprock surfaced (plasterboard) walls. He had great difficulty in locating the timber studs so that the skirting boards could be nailed to them.

Where a tradesman has to do this sort of job he would normally locate the wall studs by banging along the wall with his "calibrated" fist or knuckles. Unfortunately, our said staff member did not have such a calibrated fist and so quite a

few nails were banged through the skirting boards and then into thin air rather than into solid timber studs. Naughty words were said. But out of this frustration grew this neat little device which really works well.

Just move it along a wall and it will flash its LED whenever it passes over a hidden nail. Voila! No more bashing nails into the void between studs. And if you have to drill into masonry walls, use the Nail Finder at the spot you intend to drill and it will tell if a water pipe is buried just under the cement render (although not if it is buried very deep).

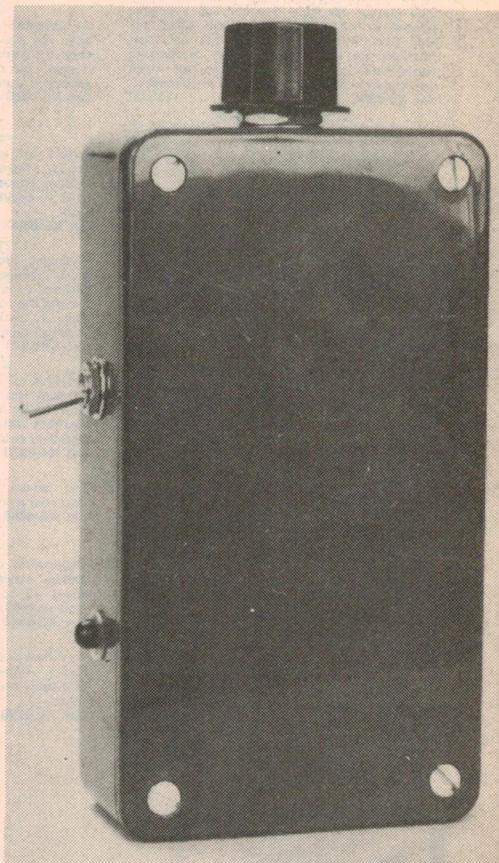
Having decided to produce this Nail Finder project we tried a number of circuits with varying success. The circuit we have finally settled on is based on a commercial device but we believe our unit is superior, as well as using readily available bits and pieces.

In fact, this is an ideal junk box project. If you use all new parts the cost will probably be around \$15 or so but if you can raid your junk box you may end up paying only \$5 or even less. The prime resource in this case is an old pocket transistor radio. If you have an old one of these you already have the most costly parts: the case and the small antenna rod. But more of this later. Let's talk about the circuit.

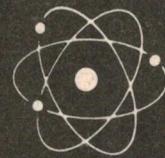
How it works

Metal locators always employ at least one L-C (inductance-capacitance) type oscillator. The inductor (or "search coil") undergoes a change of inductance whenever a piece of metal is placed in its magnetic field. This causes the oscillator frequency to shift and by measuring this shift with respect to a stable reference frequency, we can detect the presence of a metal.

With expensive treasure hunter type metal locators the search coil is quite large — up to 40cm for some models. Although this improves the sensitivity, it



Basic Electronics



by
COLIN DAWSON

PARTS LIST

- 1 printed circuit board, 55 x 27mm, code 83m9
- 1 ferrite antenna rod (approx 55mm long)
- 1 plastic box 113 x 63 x 29mm
- 1 miniature SPST switch
- 1 9V battery, Eveready 216 or equivalent
- 1 Battery snap to suit
- 1 Knob to suit potentiometer
- 4 metres of 0.2mm enamelled copper wire

SEMICONDUCTORS

- 2 BC549C NPN transistors
- 2 BC547 NPN transistors
- 1 1N4148 diode
- 1 5.6V 400mW zener diode
- 1 red light-emitting diode and bezel

CAPACITORS

- 1 10 μ F/10V electrolytic
- 1 .01 μ F metallized polyester (greencap)
- 1 .0033 μ F greencap

RESISTORS (1/4W, 5%)

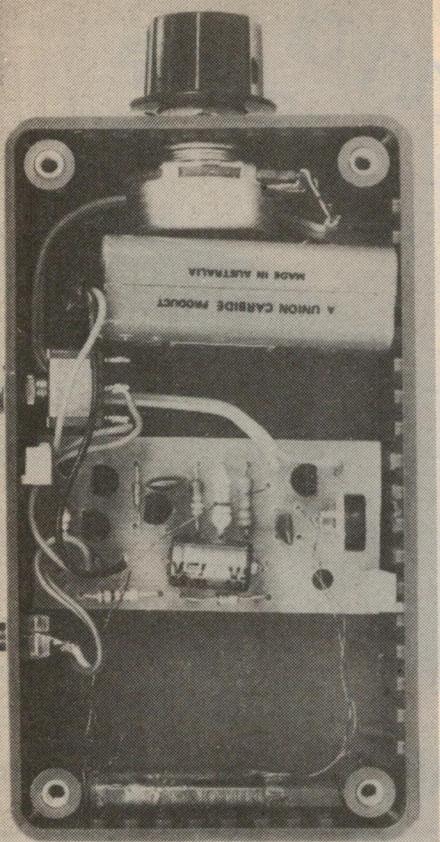
- 1 x 390k Ω , 1 x 68 Ω , 1 x 10k Ω , 1 x 1k Ω , 1 x 330 Ω , 1 x 20k Ω vertical trimpot, 1 x 500 Ω potentiometer

is not at all suitable for a nail finder. Even if we could overlook the inconvenience of the large coil, it would simply not have the resolution to pinpoint the location of a nail.

Our circuit is unconventional in that it does not measure the shift in frequency of the L-C oscillator. In fact, it doesn't even have a reference oscillator. Instead, it detects the change in amplitude in the oscillator waveform.

Whenever the coil is brought into the vicinity of a metal object, the oscillator waveform reduces in amplitude. Additional circuitry detects the reduced signal and drives an LED indicator.

If you now have a look at the circuit you will see that it uses just four transistors and very little else. Q1 is the oscillator while Q2, Q3 and Q4 monitor the oscillator amplitude and turn on the LED.



Left: The finished nail finder and, right: interior view showing the general layout.

We estimate that the current cost of components for this project is approximately

\$10

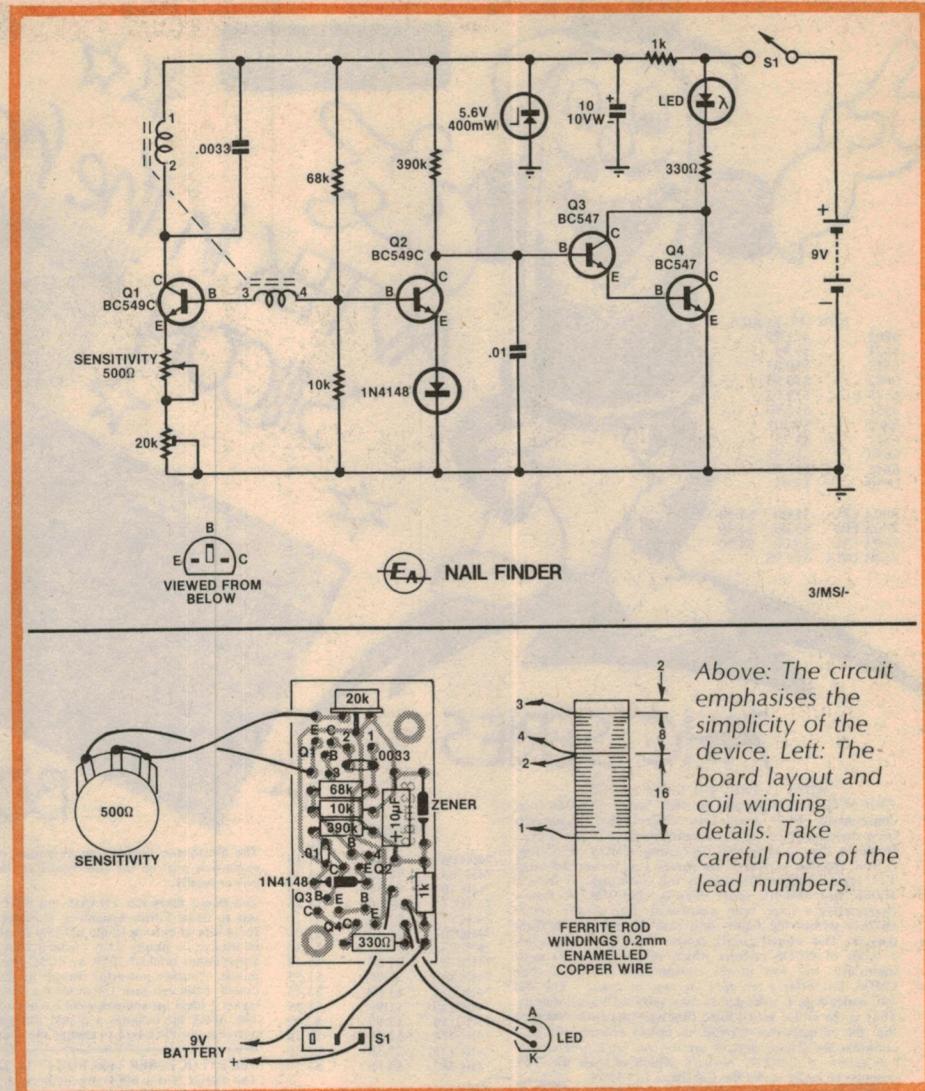
This includes sales tax, but not the cost of a box or battery.

Q1 has a tuned collector load and maintains oscillation by virtue of positive feedback via coupling from the collector coil winding to the winding in series with the base. (Both windings are on the same ferrite rod.) The amplitude of the oscillation can be adjusted precisely by trim-pots in the emitter circuit of Q1.

Introducing a metallic object such as a nail into the magnetic field between the two windings actually causes losses and so the oscillator amplitude is reduced. By contrast, placing a piece of ferrite in the vicinity of the two windings will increase the oscillator amplitude.

The $0.003\mu\text{F}$ capacitor in parallel with the collector winding of Q1 simply determines the frequency of oscillation, which is around 170kHz .

Q2 monitors the oscillator amplitude in the following way. Its base is held at a nominal 0.8V by the $68\text{k}\Omega$ and $10\text{k}\Omega$ resistors which also provide the DC bias

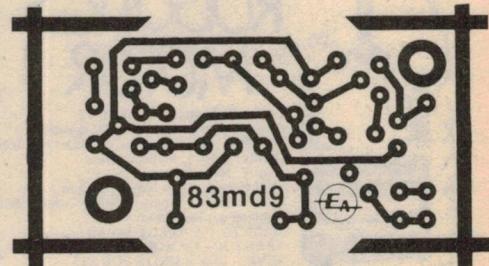
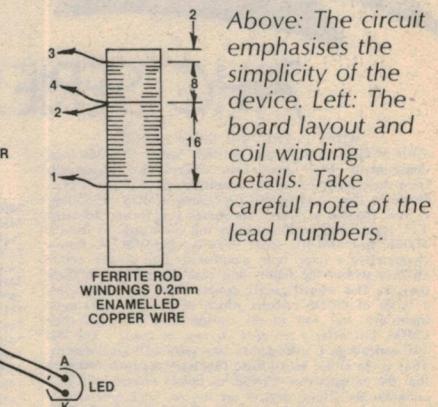


for Q1. At the same time there is a silicon diode in the emitter circuit for Q2 so that the 0.8V bias is insufficient to turn it on, when Q1 is not oscillating.

Q2 controls a Darlington pair consisting of Q3 and Q4 which drive the LED indicator. With Q2 switched off, the base of Q3 is pulled high by the $390\text{k}\Omega$ resistor. This causes the Darlington pair to switch on and drive the LED indicator (via a 330Ω current limiting resistor).

So far, we have assumed that Q2 is subject to DC conditions only, with its base held at about 0.8V . In fact, whenever Q1 is oscillating an AC signal will be superimposed on the 0.8V base bias of Q2. When the oscillations are of sufficient amplitude, the positive peak of each cycle will take the base of Q2 above its switch-on threshold.

In other words, the higher the oscillation amplitude the more Q2 will conduct and so reduce the voltage at its collector which is smoothed by a $0.01\mu\text{F}$ capacitor. Under normal conditions Q1 is oscillating and the trimpots in its emitter circuit are adjusted so that the level of oscillation is just sufficient to maintain



Q3 and Q4 barely conduct so the LED is just a glimmer. At this point a slight decrease in oscillation, due to a metallic object in close proximity to the coil, will cause the LED to light fully.

The $20\text{k}\Omega$ trimpot is used to set the detector as near as possible to its trigger point and the 500Ω potentiometer — the sensitivity control — is used for the "fine tuning". Once the trimpot has been set for a given environment, it will normally only be necessary to use the sensitivity control.

The supply rail to the oscillator and detector circuit is regulated by a 5.6V zener diode. This prevents the supply rail from varying widely due to the LED be-



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The Multiprom board is an extension of the Microbee's memory in ROM. It simply plugs into the fifty way bus expansion port on the core board. It fits either neatly inside the Microbee or behind it, using the Microbee's own power supply.

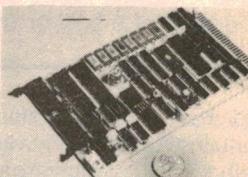
The board takes the EDASM and NET eproms normally residing inside the Microbee, but allows several different sets to fit in: Editor-Assembler, Wordbee, Logo, MiniPascal, Networkrom, Bemon or your own program. It has room for 4 sets of eproms in the EDASM location and 3 sets of eproms in the NET location, a total of 44K of eprom. The EDASM locations accept either type 2532 or 2764 eproms and they can be mixed. Another powerful feature of the board is the input/output system, 11 outputs, open collector transistor driven. Each can turn ON or OFF a relay under program control. 8 inputs, buffered and protected can read 8 switch status - ideal for computer controlling of model trains, alarm systems, tape recorders, machinery etc. The Avtek kit includes a plated through board plus all components to make this exciting project. There is also provision on the board to change the address of the ports used for eprom selection and input/output.

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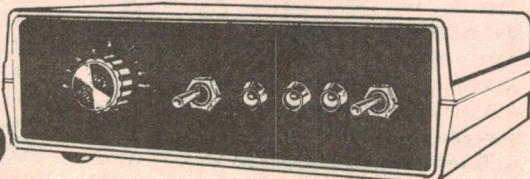
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Nail Finder: the electricians mate

ing turned on and off. The 5.6V zener is a 400mW type. 1W types should not be used as they require more current to regulate properly.

An old pocket transistor radio with an all-plastic clip-together case would be ideal for this job. If you can salvage the ferrite rod as well, so much the better.

If selecting a commercial box for the project, choose one which will allow the ferrite rod to be mounted at least a few centimetres from both the battery and the 500Ω potentiometer. To achieve this with our box, it was necessary to shorten the ferrite by about 1cm so that it would fit between the screw mounting posts. This is really quite easy — just score a groove around the ferrite using a file and it will snap cleanly along the groove without too much effort.

Trim the board

The printed circuit board (PCB) used is coded 83md9 and has nominal measurements of 55 x 27mm. Actually, up to 5 of the 55mm can be trimmed from the board if you are really pressed for space. The extra is to allow the board to clip neatly into the special PCB stand offs supplied with the plastic utility box.

When mounting components on the PCB, particularly watch the polarity of the two diodes and the electrolytic capacitor. Also, wire the LED and the coils exactly as per the wiring diagram.

Four holes must be drilled in the box — one for the LED, one for the switch, one for the sensitivity control and one for the trimpot. This last hole is not actually to mount the trimpot, but rather to allow screwdriver access to it.

When winding the coils, use 0.2mm enamelled copper wire. Although the number of turns is not critical, try to make the windings as near as possible to 8mm and 16mm long, respectively. Leave about 60mm of wire free on each of the ends and scrape the enamel off for about the last 5mm. These leads must be connected to the PCB exactly as per the wiring diagram, otherwise the oscillator will not work.

For the finishing touches, dab some glue onto the ferrite and fix it in position and then select a knob for the sensitivity control. When performing the initial test, don't use the sensitivity control to set the LED — use the trimpot on the PCB. This is a much coarser control and should be used to set the LED on the threshold of conduction. The sensitivity control is then adjusted so that the LED is just beginning to illuminate before any metal is detected.

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The principle of the log-periodic antenna

How to obtain better TV reception Pt. 4

While there appear to be a large number of different TV antenna designs they tend to fall into two broad categories: Yagi and log-periodic. Both use dipole elements but the log periodic design has advantages in a design which is intended to cover all channels from 0 to 11.

by LEO SIMPSON

As noted in the last article in this series, in the August issue, the Yagi antenna is essentially a narrow bandwidth design by virtue of the resonant character of its elements. In fact, it is quite difficult to design a Yagi to cover more than one-third of an octave (ie, a frequency range of 1.3:1) and such an antenna would have a lot of directors and not a great deal of gain.

To overcome this problem, designers usually combine two Yagis on the one boom and couple them together. A popular example of this is the Austenna A10-80 model which covers channels 0,

2, 7, 9 and 10. See facing page. The three long elements (reflector, folded dipole and angled director) provide coverage of channel 0 and 2 while the shorter elements cover the other channels.

While such multi-band Yagis do give sterling service they cannot give optimum performance for every channel. For example, you may be able to resolve finer picture detail on one channel than on others and this will be because the Yagi covers the particular channel's 7MHz bandwidth better than others. Alternatively, one channel may give noisier reception than others

because the antenna's gain is less than for the other channels.

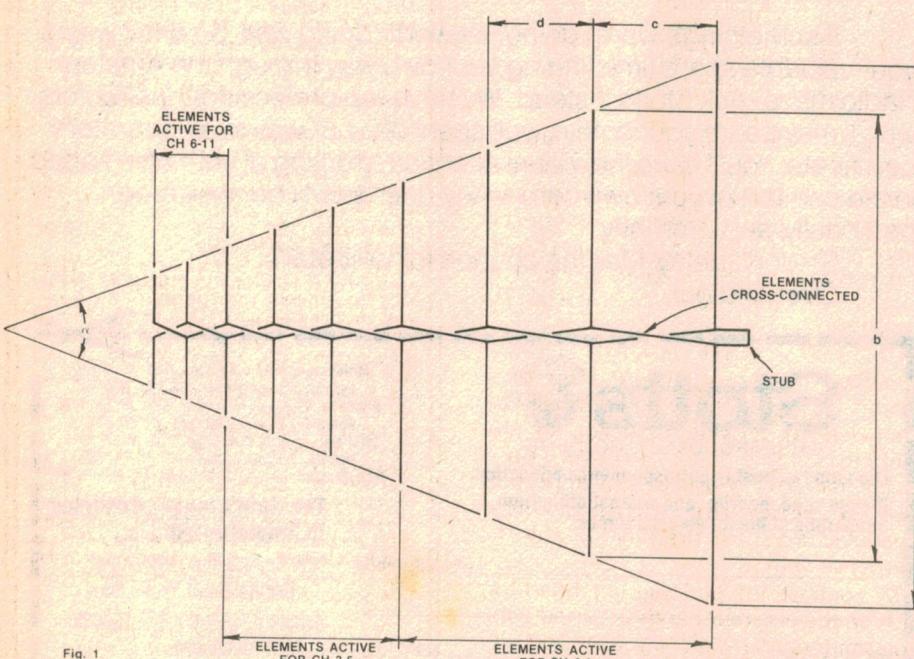
The solution to this problem of designing an antenna which gives equally good performance for all VHF channels (from 0 to 11) was just about insoluble until the late fifties when a new antenna design was developed which was referred to as the log-periodic dipole array or LPDA. These days people normally refer to them simply as "log-periodics".

Fig. 1 shows the general arrangement of dipole elements in a log periodic antenna. The length of the elements increases gradually from the front to the back as does the spacing between each pair of elements. As might be gathered from the "log periodic" designation, the overall taper from the front to back and the spacing between the elements increases in a logarithmic relationship or, more simply, as a geometric progression.

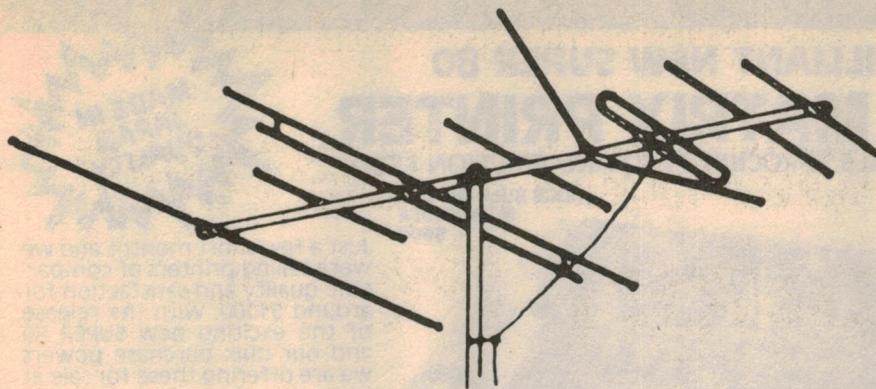
In fact, the ratio between the spacings of adjacent pairs of elements and the ratio of the lengths of adjacent elements is the same and it remains constant throughout the array. The ratio is known as the Tau factor and it is this factor plus the included angle of the array taper, alpha, which defines the overall gain of the antenna.

The overall frequency range of the antenna is defined in the same way as for a Yagi array. The longest dipole sets the low frequency end and the shortest dipole the high frequency end. This means that a log-periodic antenna can cover the whole VHF TV band with relatively few elements tapering from very long to quite short in as few as four steps, say, or at the other extreme, it may be very large indeed, with a multitude of elements for the same frequency range.

For a high gain array, the included angle is made small so that a relatively large number of elements is required to cover a given bandwidth. It follows that to obtain a reasonable gain from a log-periodic and also to cover the whole VHF TV range from 45 to 222MHz the resulting antenna will have to be very large.



This is the typical configuration for a log-periodic dipole array. The ratios b/a and d/c are identical for all adjacent pairs of elements. In any frequency band three or four sets of elements are active. The stub is dimensioned to give matching to the feeder line and is not present in many commercial designs.



In order to overcome the problem of making a Yagi antenna cover all VHF channels designers have combined two Yagis on the one boom such as the Austenna A10-80. (Diagram by courtesy of Austenna Systems Pty Ltd, Rydalmere NSW.)

In practice, typical commercial log periodic antennas intended for TV reception are a compromise between gain and overall size of the array. The largest commercially available array has a boom length of about 3.2 metres which is still pretty large.

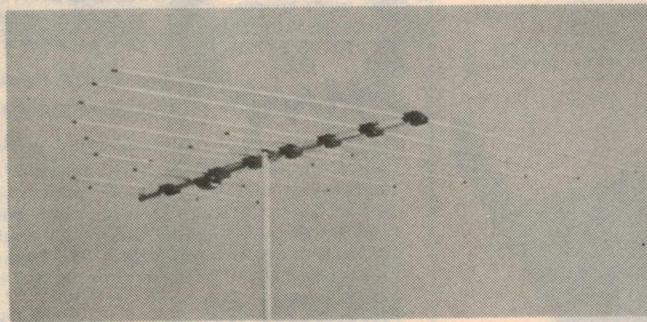
Apart from the characteristic tapering of the array, log periodics have another feature which gives them an unusual appearance. Each pair of dipole

mounted on each boom (not insulated) and the antenna output connection is made to the front end of the booms. An example of this method of construction is the Hills EFC3 and EFC4 antennas which are illustrated on page 93 of this article.

These two Hills antennas are unusual in a number of respects, as will be discussed in a moment.

As a glance at the photos included with

This is the Hills HD4, a large log periodic with additional parasitic elements to increase the high frequency gain. It is made of stainless steel to resist corrosion. (Photo courtesy of Hills Industries Ltd.)



elements is reversed in phase compared to the adjacent pairs. When combined with the length of the feeder connecting each adjacent set of dipoles this has the effect of giving a strong directional effect to the antenna.

Putting it another way, for a given pair of dipole elements, the shorter elements in front act as a director while the longer elements at the rear act as a reflector.

Two methods are used to reverse the connections to each set of dipoles. The first and most common way is to mount all the elements on a single boom but insulated from it. Then heavy gauge wire or metal strips are used to make the respective crossover connections. The Austenna CC9FA log periodic antenna illustrated on page 91 of this article is a typical example of this method of construction.

The other method of construction uses two booms, one below the other and electrically isolated from each other. In this way, alternate elements are directly

this article will show, Fig. 1 is a notional antenna only and typical commercial antennas, while broadly conforming to the same pattern, do show a number of divergences. For a start, the stub shown on the rear of the antenna in Fig. 1 is usually not present in commercial TV antennas.

The stub is merely a length of short-circuited feeder or a wire loop of a particular length and would normally be included to provide matching of the antenna to the load. However, since such matching is usually not important for a receiving antenna, the manufacturers are presumably able to dispense with it.

By contrast, log periodics intended for use on the amateur bands are used with transmitters and matching is important. So for amateur use the matching stub is a crucial part of the antenna design.

Another difference with commercial versions of the log periodic antenna is that they usually have additional short



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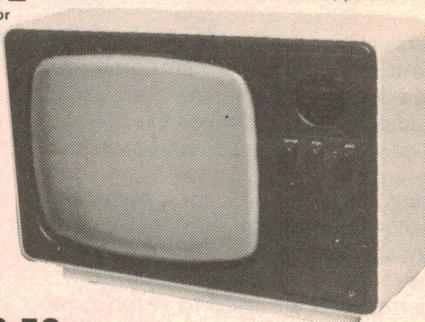
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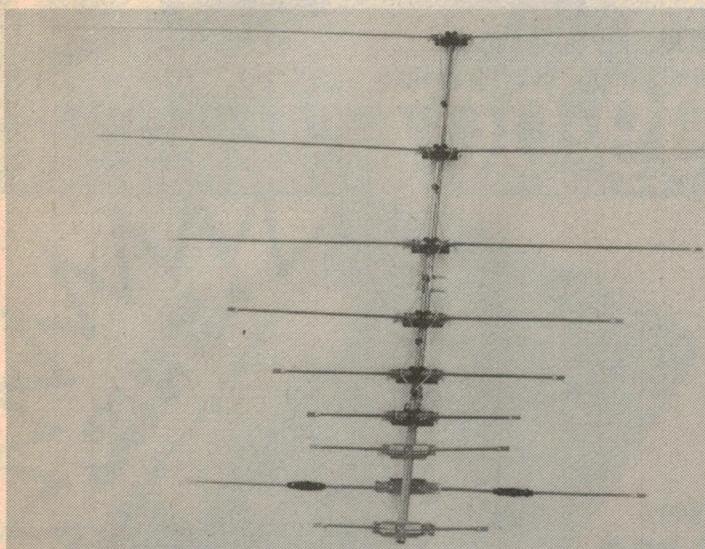
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How to obtain better TV reception



This is the Austenna CC9FA log periodic antenna which is constructed on a single boom and has additional parasitic elements for improved high frequency gain.

elements which may be in front of the main log periodic section or they may be distributed all the way along the boom. An example of the former case is the Austenna CC9FA previously referred to, on page 91 of this article.

This antenna has six pairs of elements in the log periodic array but has three additional short elements on the front end of the boom. Note that these elements are mounted directly on the boom but are not connected in any way to the dipoles. These elements are acting as additional directors for the shortest dipoles in the array.

One of these directors has an additional extension at each end. This presumably allows it to operate as a director for some of the longer dipoles in the array.

The reason for adding these directors is to improve the gain and the directional properties of the basic log-periodic configuration in the upper region of its frequency range. This is usually found to be necessary because as pointed out before, the upper and lower limits of the frequency range of a log-periodic array are defined by the shortest and longest dipole elements, respectively.

This means that, whereas intermediate dipoles have the benefit of shorter dipoles acting as directors and longer dipoles acting as reflectors, the shortest dipole element does not have any directors. Hence they are added to give a worthwhile increase in gain.

At the other extreme, it is not usual to add a reflector element for the longest dipole to improve the low frequency gain. This is not necessary because these very long elements pick up a very strong signal in any case. Remember that the

received signal is directly proportional to the product of the signal strength (in mV/m) and the dipole length.

The Hills EFC3 and EFC4 also add parasitic elements to the front of the log periodic array to increase high frequency gain. These elements are said to be collinear in that because of the insulator which breaks them into three equal parts, they can operate in the high frequency and mid-frequency portions of the antenna range.

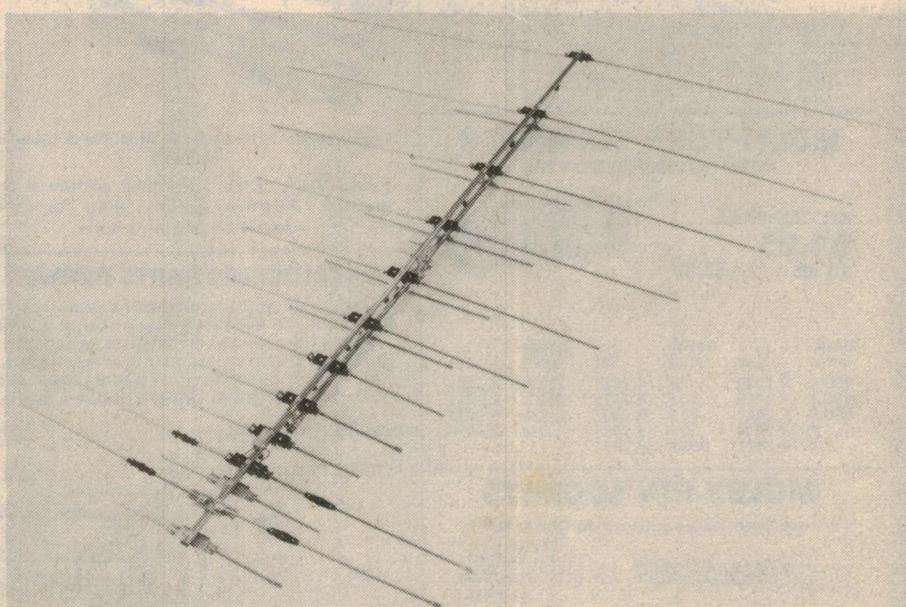
Antennas which use a combination of log periodic array and additional directors are often termed a "hybrid log periodic" or a "log-Yagi".

Besides having an essentially flat gain characteristic over the whole of its design passband, the log periodic also has a very smooth polar response characteristic, as illustrated on page 93 of this article. This has a fairly broad frontal response lobe and a smaller lobe to the rear, giving quite a good front-to-back ratio.

This is not the whole story though. Note that we have shown two such polar response curves, one being typical of a high band response and one being typical of the low band. Note that the low band response has just one small rear lobe, as would be expected from a log-periodic design.

With the accompanying high band response there are two small rear lobes. The two rear lobes are typical where additional directors have been added to improve the gain. They sharpen up the frontal lobe, as well as providing the extra rear lobes. In this latter respect the performance is becoming similar to that of a three or four-element Yagi which has several rear lobes.

So what have we so far, as far as polar response is concerned? We have a very smooth response which is free of the many small rear lobes and deep nulls "off the back and side" of the antenna which is usually typical of multi-element Yagi designs. But while the log-periodic may have a better front-to-back ratio on paper, the existence of those deep nulls in the polar response of a typical Yagi may be better for eliminating ghosts. Note also that because the log-periodic does not have the benefit of a reflector



One of the largest log periodics available, this Austenna CC19FA uses crossover wires to connect the dipole elements and a second boom to mount five additional parasitic elements.

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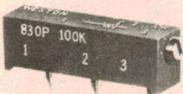
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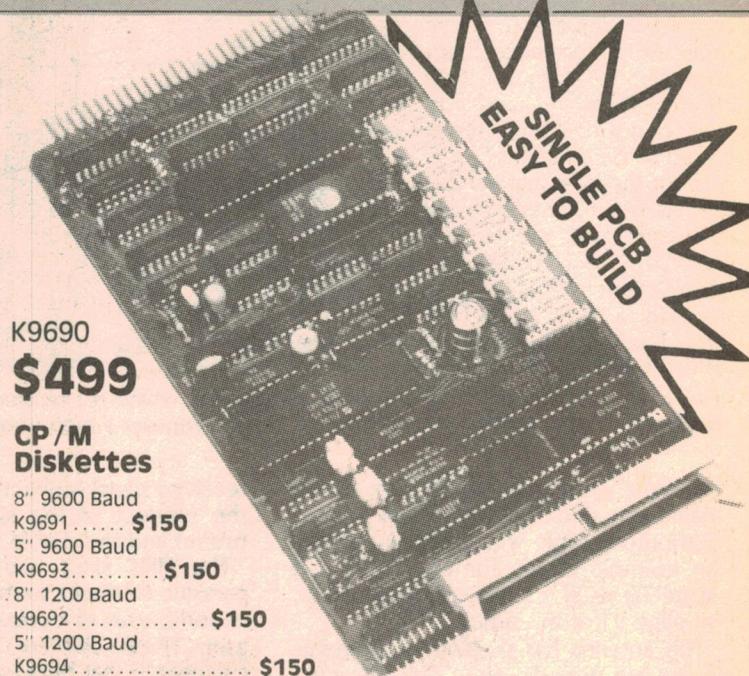
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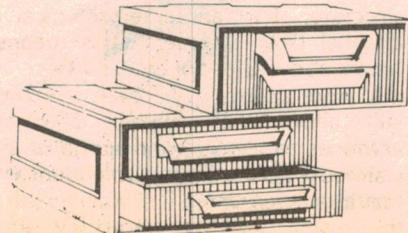
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How to obtain better TV reception

at the low frequency end of the band, the polar response usually suffers with the result that it is not as good as the mid-band polar response.

Surprisingly, Australian TV antenna manufacturers have appeared to adopt a very low profile and do not generally publicise performance figures for their products. So even for the reasonably informed user making judgements on likely performance of different brands is bound to be difficult.

About the best that can be said is that the size of a log periodic is the guide to its overall gain; the bigger the better. Even so, the gain of even large log periodic antennas is quite modest. And since, for a given frequency band, only three four of the dipole elements are active, the gain is comparable with that of a three or four element Yagi.

So far as gain and polar response is concerned the log periodic design is good without being outstanding. It is as close as the antenna manufacturer will ever get to being the "good all round performer" for the whole VHF range.

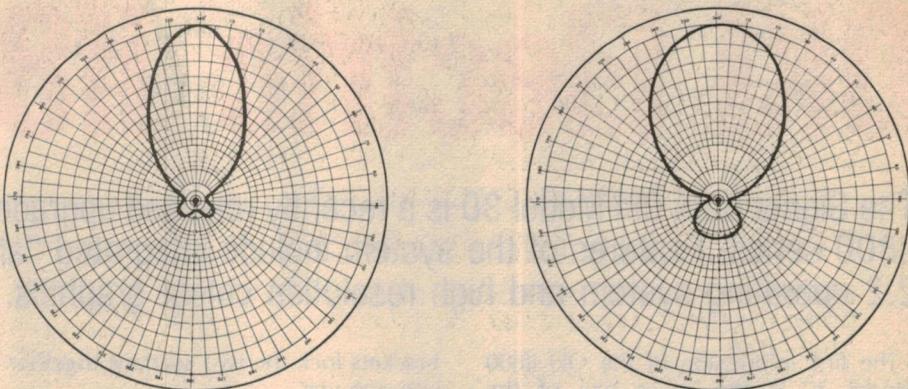
For that reason it has become very popular with Australian manufacturers and has been installed in very large numbers in recent years. But for fringe areas where the signal level is quite low or in areas where pronounced ghosting occurs it is not the best answer. Nor is it necessarily the best practice to install a log periodic and then make up the gain by adding a masthead preamplifier.

In all this talk of gain, frequency response and polar response we have not been entirely realistic. One of the reasons why Australian manufacturers are reluctant to make a big deal about the performance of their antennas is that so much depends upon the actual installation. Relatively few are ideal.

Most TV antennas are simply installed on a bargeboard using a short J-bracket which puts the antenna only about one metre above the metal guttering and in most cases, not even clear of the line of the roof. The presence of a large metal structure in the near vicinity to an antenna inevitably degrades the polar response. It never improves; it always worsens.

So while you may start out with an antenna which is designed to have excellent directional characteristics, this typical sort of installation may easily degrade it to the point where it is more or less omnidirectional with little or no front-back ratio. Thus the ability of the antenna to cancel out ghosts is lost.

Worse still, that ubiquitous length of metal guttering may very well resonate on the frequencies of one particular channel. It can then re-radiate its



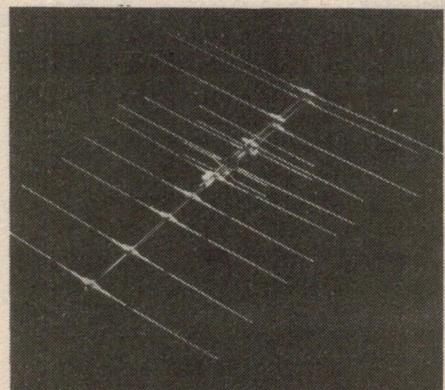
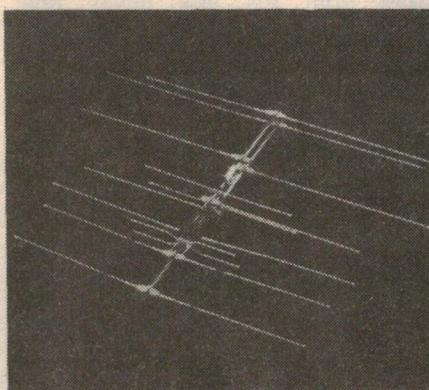
These are polar response diagrams for a typical log periodic antenna. At left, the high band response and at right, the low band response.

received signal into the antenna and cause signal cancellation. This could result in poor reception on one channel.

Installing a TV antenna within the roof is often just as bad. Not only will the antenna be surrounded by roof guttering and mains wiring but it may also have to "look past" a hot water system or water pipes. And in rainy weather the wet roof tiles will weaken the signal. About the

the surrounding structures or terrain. For an antenna receiving channel 0, the height above the roof, or at least above the guttering, is about 3.2 metres.

As well as reducing the degrading effect on the polar response, raising the height of an antenna almost always gives an improvement in received signal. The amount of increase will depend on just how far you are from the transmitter and



Two hybrid log periodics made by Hills: The EFC3 (left) and EFC4 (right). (Photos by courtesy of Hills Industries Ltd, Edwardstown, SA).

best that can be said for such an in-roof installation is that it may be reasonably satisfactory in strong signal areas and it will prevent the antenna being damaged by the weight of perching birds.

Unfortunately, the only way to obtain the claimed directional characteristics of any antenna is to install it well above any surrounding structures, metal or otherwise. Ideally, it should be at least three or four wavelengths above any structure. For an antenna receiving channel 0 or channel 2 this means a height above the roof of 25 metres.

A more practical approach which will still allow most highly directional antennas to give a good quota of their claimed performance is to mount it so that it is at least one half wavelength, at the lowest operating frequency, above

on the intervening terrain. If you live in a hilly area a relatively small increase in elevation may give a very worthwhile increase in signal level.

There is another advantage of mounting the antenna as high as possible which is not generally realised and this is that it can make the reception less prone to ghosts caused by aircraft. The reason for this is that ground reflection effects tend to mean that the greatest signal pickup is not in the plane of the antenna but from an angle above the horizon.

In other words, mounting the antenna close to the ground or not far above surrounding structures has the effect of tilting the polar response of the antenna upwards, just the ideal situation for picking up reflected signals from aircraft! (Continued next month.)

Electronics Australia reviews the . . .

OKI Electric if800 'all-in'

The Sigma Data Oki Model 30 is a recently released upgrade of the Oki Electric Company's if800 series. Features of the system include integrated "all-in-one" packaging, the CP/M 2.2 operating system and high resolution colour graphics.

The first impression of the Oki if800 Model 30 is the sheer size of the machine.

Dimensions of the complete system are $55 \times 71.5 \times 51$ cm (W \times D \times H) and mass is a hefty 53kg. Sigma Data, who distribute the machine in Australia, claim that the space occupied by the if800 is comparable with other computer systems once the space saved by the built-in printer is taken into account, but the impression of bulk remains.

While big, the system is complete. The keyboard, colour video monitor, dual 20cm disk drives and full-size dot matrix printer are all combined in one large package.

As delivered the if800 is in two parts, one containing the keyboard and printer and the other holding the power supply and processor board, with a 30cm colour monitor mounted on pillars above the rearmost unit. Next to the CRT screen are dual 20cm disk drives.

To install the Oki, first clear your desk. The two units are connected with three multi-way cables and the keyboard section fitted into the open front of the rear part. Two screws through small metal

brackets lock the two sections together into one unit.

The integrated configuration has one immediately obvious advantage — there is only one power cord and a single power switch for the system, conveniently located on the left side of the console.

Forward of the power switch and also on the side are two small pushbuttons, one labelled "IPL" and the other NMI. Preparing the if800 for use is a matter of loading a disk into drive A and pressing IPL. Within seconds the disk will load (indicated by colour cycling of the screen border and various clunks and whirring noises from the disk drive). Brief messages on the screen report the status of program initialisation before the screen clears and the CP/M operating system is activated.

Specifications

The Oki if800 Model 30 is based on a Z80B microprocessor running at a clock rate of 4.9152MHz. Programmable memory is provided in the form of 64K \times 1-bit dynamic RAM chips, with 128K bytes provided with the standard

machine and an additional 128K provided by an optional memory expansion board.

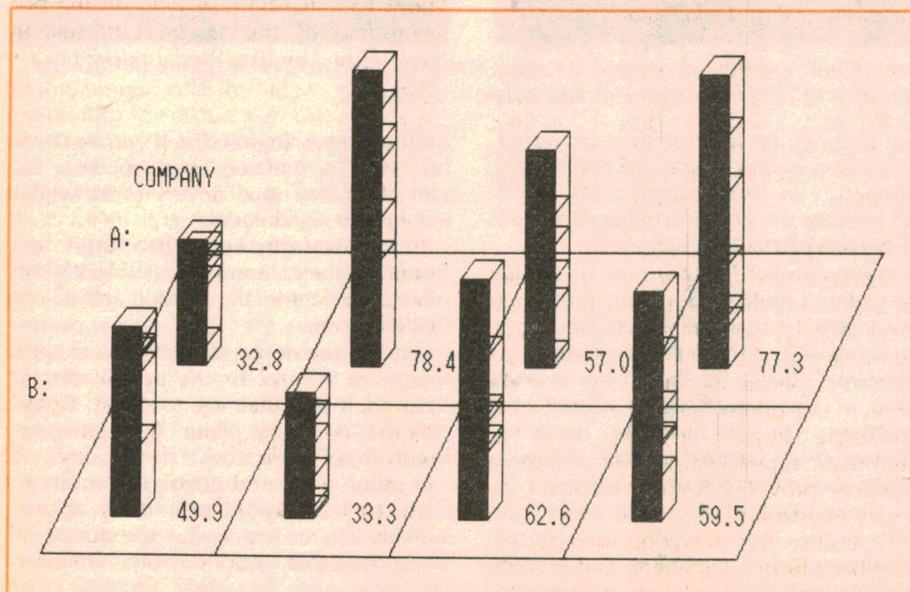
Two configurations of the system are available. One, the IF80150 (reviewed here) has a colour display while the IF80160 has a monochrome display. In the colour version video memory consists of three 64K planes (one each for red, green and blue) for a total of 192K bytes.

The standard machine includes an on-board clock/calendar with internal Nicad battery backup so that the time and date are maintained whether or not the machine is switched on. A sound generator is also provided, generating 64 tones over a range of 65Hz to 1976Hz through an internal speaker.

An RS232C serial port is built into the standard machine and a Centronics parallel port is available as an option. With a full-size 80cps dot matrix printer built in to the keyboard console, the lack of a Centronics port on the standard unit is probably not important. If correspondence quality printing is required any of the available daisywheel printers can be connected to the serial port.

The built-in printer is a fast impact printer, able to produce multiple copies on either single-sheet or tractor feed paper. Lines of 80 or 132 characters can be specified and graphics, including a printed copy of the screen display, are also available. Individual characters are formed on a 5×13 dot grid in a 16×16 dot matrix, allowing full descenders on lower case letters and the production of user-defined graphics symbols. Double-size, enhanced and boldface type can also be produced, and in fact the version of WordStar available for the if800 supports all the features of the printer.

The if800 is well-equipped with peripheral interfaces and expansion slots. Built into the standard machine are interfaces for a light pen, communications port, and a ROM cartridge. Five expansion slots are provided in the processor unit, with two already occupied by controller boards for the colour graphics display and the disk drives. The three vacant slots can be used with



This 3D bargraph was dumped from the screen to the in-built printer.

'-one' computer



The iF800 comes complete with printer, colour monitor and dual disk drives.

parallel and serial add-on boards, D/A and A/D converter boards or an IEEE 488 communications bus adaptor board.

Currently available optional extras also include a light pen which is connected by a socket on the right side of the machine. In conjunction with a Basic program the pen can be used to indicate a specific 40×200 pixel area on the screen or to select items from a menu by touching a point adjacent to the written description of the menu entry.

The ROM slot on the left side of the console can be used for cartridges which contain programs or data, although as yet no program cartridges have been released. The information stored in a ROM cartridge does not appear in the memory space of the iF800 but can be copied into RAM for use. Up to 20K bytes of information can be stored and accessed in this way.

A "Kanji" cartridge is available for use as an add-on character generator. This ROM pack contains patterns for 2965 Japanese kanji characters, alphanumeric characters, and Greek and other special symbols.

The keyboard

The keyboard of the iF800 is extensive. In addition to the standard alphanumeric keys in a typewriter-style layout and a numeric pad, the 104 keys include cursor control, special function keys for the screen and printer and a set of 10 user definable keys. All keys have an automatic repeat feature and an internal speaker provides audible feedback for every keystroke.

Of course not everyone likes audible feedback from a keyboard. Unfortunately, with the iF800 it is not an option — there is no way to disable the feature (or

if there is we couldn't find it in any of the system manuals). With a noisy cooling fan, noise from the disk drives and compulsory audio from the keyboard the iF800 is obtrusive — a point which must be considered in an office or home environment.

Other features of the keyboard include completely redefinable keys, a Japanese character mode, access to special graphics characters and single key entry of common Basic statements.

The user-definable keys above the alphanumeric keyboard can each be assigned a string of up to 15 characters. Pressing the function key then has the same effect as typing this string.

As initialised, the keys perform various functions under CP/M and a different set of operations under Basic. Under Basic, for example, pressing F1 will print the statement LOAD on the screen, ready for the user to type in a program name to be fetched from disk.

Under CP/M, pressing F1 will print "dir", the instruction to list the directory of a disk drive on the screen. Pressing F6 will call up DDT, the "Designers' Debugging Tool" of CP/M, while F10 will load Basic.

From Basic the statements KEY, ON KEY () GOSUB ... and KEY LIST will respectively assign functions to the programmable keys, call subroutines according to the key pressed and list the current definitions of the keys.

A row of touch switches directly below the video monitor duplicates the operation of the function keys. It would be possible to write software which required no use of the standard keyboard at all, by presenting a series of menu-driven operations with options called up by the function keys. A list of key definitions can also be displayed on the bottom line of the screen conveniently above the key that the label refers to.

To the right of the alphanumeric keyboard are two clusters of four cursor control keys (marked with arrows) and the editing function keys INS, DEL, CLS and HOME. The 20-key numeric keypad is further to the right and includes its own separate keys for arithmetic operators and a separate RETURN key for easy entry of numeric data and calculations.

Above the numerical keypad are three keys for control of the in-built printer. From left to right they are "Hard Copy", "Form Feed" and "Print" (a latching key with a LED indicator). "Hard Copy" will produce a printed copy of the current contents of the screen, using double-width characters and reproducing all graphics (but not colour). Shift-Hard

Continued on page 96

OKI Electric if800 'all-in-one' computer

Continued from page 95

Copy will provide a reduced copy of the screen image.

The "Print" key, when locked down, will send all text information to the printer as well as to the screen, using normal size characters. It does not reproduce graphics, but is handy for generating program listings and permanent copies of program output in conjunction with the LIST statement of Basic. LLIST from Basic will also activate the printer, and the LFILES statement will produce a printed list of the contents of a disk directory.

Horizontal tab and tab setting keys complete the complement of special functions in the upper area of the keyboard.

At both sides of the space bar are other special function keys which are more of a nuisance than an asset in English-speaking countries. The first, labelled CHR MODE, is a locking key with a LED indicator. It operates to replace all characters with boxes on the screen, and is presumably designed to work with a Japanese character generator which is

not installed in the standard machine.

Accidentally pressing this key makes it appear that the if800 has developed a strange fault, but there is no information in the manuals on this aspect of the system.

To the right of the space bar are three unmarked keys, one of which is locking and sports a LED indicator. Locking this key down causes the standard keys to be displayed as further Japanese characters, a function of dubious value if you can't read Japanese.

Single key entry of Basic statements is supported by the if800. Pressing the COMD key (on the left side of the keyboard) in conjunction with an alphabetic key will print the Basic keyword associated with that key. COMD-G, for instance, prints GOTO, COMD-E prints ELSE and COMD-F prints FOR and so on.

A GRAPH key to the left of the spacebar allows various graphics characters to be displayed on the screen from the keyboard. Each key alphanumeric key has a pre-defined graphics symbol associated with it, but the Basic statement DEF CHR\$ allows the



Colours on the video monitor are reproduced black by the printer.

programmer to redefine these symbols to create customised characters on an 8 × 16 dot matrix grid. The standard graphics set includes line segments, boxes, card suites and some specialised symbols for cross-hatching and area fill.

While the keyboard of the if800 has many features, user comfort is not one of them. Apart from the compulsory audible feedback, the lowest part of the keyboard is around 8cm from the desktop and there is no room for a "wrist rest" as found on some of the more popular low-profile keyboards. Using the if800 for prolonged periods could be very fatiguing for this reason.

Screen display and graphics

High resolution colour graphics is the best feature of the if800. The colour version of the Model 30 comes with a high bandwidth RGB monitor, capable of displaying up to 25 lines of 80 characters each and graphics in eight colours with a resolution of 640 (horizontal) × 400 (vertical) pixels.

This exceptionally high resolution means that further colours can be created on the screen. Using a technique which Oki call "dithering", shades of various colours can be built up by juxtaposing the available colours. For example, a line made up of alternate red and green points will be perceived as a solid line of some shade between red and green because of the fine detail of the display. Using red for 70% of the pixels and green for the remainder will produce yet another shade. According to the distributors up to 120 distinct shades of colour can be created in this way.

Four options are available for text displays, allowing either 20 or 25 lines of either 40 or 80 characters each. Both graphics and text displays are clear and sharp, and the colours are fully saturated, not the more common "washed out" tones more usually seen.

The display capabilities of the if800 are fully supported by the Basic interpreter



Eleven keys below the screen are paralleled to keys F1-F10 on the keyboard.

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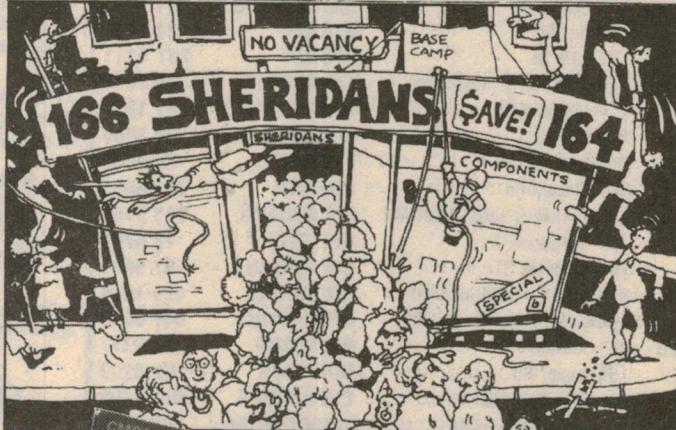
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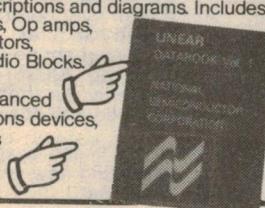
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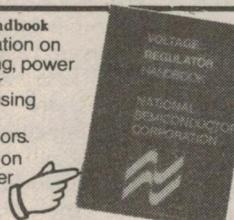
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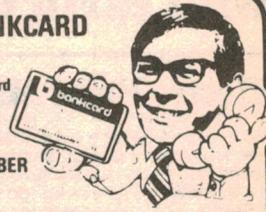
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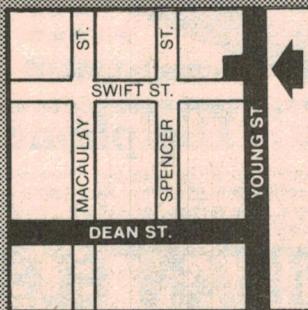
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Continued from page 96

provided with the system. Size of the text display format is selected with the WIDTH command while the CONSOLE command allows other display attributes to be modified, including the scrolling area of the screen, the function key label display and the scrolling speed of the display.

Rather than scrolling over the full height of the screen the if800 can be instructed to scroll only part of the screen by specifying the top line of the scroll window and the number of lines to be included in the window. Lines are numbered from 0 to 24 in the 25 line mode and from 0 to 19 in the 20 line mode.

The fourth parameter of CONSOLE controls the speed of scrolling. When "0", scrolling will be performed on a line by line basis, called "jump scroll" by Oki because of the jerkiness of the resulting movement. Specifying a value from 1 to 255 will select smooth scrolling (pixel by pixel movement). The lower the number the faster the scrolling speed.

Further basic statements allow cursor positioning on the screen and the display of text in any position and in a variety of sizes and orientations. The SYMBOL statement of Basic, for instance, displays a specified character string at a specified position on the screen, and allows the selection of a variety of type sizes. Character strings can also be rotated in increments of 90 degrees for labelling graphs etc.

The display screen of colour versions of the if800 is "bit-mapped" in three planes, one each for the red, green and blue components of a screen image. Each bit plane can be displayed and erased separately, allowing a multitude of special effects. Different colours can be selected for the characters displayed, the screen background and the border of the screen with the Basic COLOR statement (the English spelling "COLOUR" will generate a syntax error).

Further Basic statements support graphics, with statements to set and reset individual pixels to any colour, draw lines using either relative or absolute co-ordinates and fill areas of the screen with colour until a boundary of a specified colour is encountered. A "graphics sub-language" accessed by the DRAW statement allows specification of connected lines, angles of rotation and various scaling factors using strings of parameters, and the statements GET and

The if800 has a comprehensive keyboard with dedicated function keys and LED indicators on the locking keys.

PUT will respectively store a graphics image in a data array and re-display it.

There is also the CIRCLE statement, which will give draw circles, as the name implies. Given various parameters the statement will also draw arcs and ellipses and optionally fill the shape with any of the available colours.

To make best use of graphics displays usually requires some adjustment of the screen for the best picture, and the if800 has a conveniently placed brightness control tucked into a recess beneath the left side of the screen. Controls for contrast and vertical and horizontal adjustments are at the rear of the monitor and would require use of a screwdriver. No adjustments were necessary on the review machine.

A knurled knob on the leftmost supporting pillar of the display allows the tilt angle of the screen to be adjusted, but of course the design of the if800 does not allow the screen to be swivelled. The RGB monitor is always directly in front of the user, at a distance of perhaps 45cm, since the keyboard is not detachable. Tilting the display screen should eliminate most problems with glare, but attention would have to be given to lighting of the environment, since the physical configuration of the if800 is not as flexible as that of modular systems.

Disk storage and software

Next to the CRT screen are two vertically mounted 20cm disk drives, each providing 968K bytes of useable storage for programs and data. Several other disk formats are supported, including the IBM 3740 single density single-sided standard. Using this format disk, capacity is reduced to 239K bytes but disks are compatible with the standard CP/M 20cm disk format, allowing the if800

user to take immediate advantage of the thousands of programs available in this format under CP/M 2.2.

Supplied with the review system was a disk containing the CP/M 2.2. disk operating system and "OBasic", Oki's extended version of Microsoft Basic80. Features of this interpreter include variable names up to 40 characters long, the CHAIN and COMMON statements which allow one program to call up another while preserving a common set of data between the two, and extensive support for the graphics, sound, I/O and extended memory facilities of the if800.

Statements and functions of OBasic are listed in Table 2, but some of the more unusual features may require explanation.

AUTO, as might be guessed, enables the automatic generation of line numbers, a great convenience for programmers. Parameters to the command allow the specification of the starting line number and the increment between lines. The RENUM command is also available to change line numbers of a program or part of a program.

BEEP will sound a tone from the internal speaker, while the PLAY statement provides control of the five-octave sound generator by use of a parameter string specifying the octaves, notes and rests to be played.

The statement BLOAD will load a machine language program from disk to a specified area of memory, and the CALL statement is available to activate the routine. The USR statement is also supported, but unlike CALL it does not allow parameters to be passed to the machine language program.

While the EDIT command allows editing of lines using the cursor control keys and INS and DEL, "full screen" editing is also available. In this mode the user moves the cursor over the characters to be changed and inserts,

Continued on page 101



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deletes or types over existing text to make the changes. On pressing RETURN these alterations will be incorporated into the program on display. When line numbers are changed in this way the result is a new line, while the existing line also remains in memory with the previous line number.

The SELECT statement allows the programmer to specify one of a number of

banks of memory, each of 32K. When a memory expansion board is installed in the if800 up to four such banks are available and can be used as the Basic program area, or for storage of "extended arrays" (indicated by the use of the DIM@ statement). The extended array declared by this statement is stored in the memory bank specified by the number used with SELECT.

CHAIN@ also uses the extended

memory capabilities of the if800. A number of programs may be loaded from disk at the start of a session and called up by the CHAIN@ statement. Since the programs are already in memory access is much faster than if a program is loaded from disk each time it is required.

The real-time clock of the if800 is supported with the statements TIME, TIME\$, DATE and DATE\$. PRINT TIME will display the current count of the clock while PRINT TIME\$ will display the time (to the second) in 24-hour format PRINT DATE\$ will display the date, month and year. When using Basic, pressing Function key six will have the same effect as PRINT DATE\$, TIME\$.

Extensive support is also provided for the communications functions of the if800. Peripheral devices can interrupt the execution of a Basic program when enabled by the COM ON statement. Once enabled, subsequent use of ON COM GOSUB xxxx lets the program incorporate routines which will only be entered on receipt of data through the RS232C communications port.

The ON PEN and ON KEY statements function in the same way to allow light pen or function key inputs to be handled from within a Basic program.

For additional versatility there is the OBasic TERM command which allows the if800 to operate as a terminal using the RS232C interface. Either full or half duplex communication formats can be used and an extensive range of control codes and ESC sequences allows control of screen formats, communications protocol and the internal printer. Most Basic statements can be executed in a "remote" mode, which carries out the operation specified and outputs the result to either the terminal or the host computer.

OKI if800 Model 30 Specifications

Processor:	Z80B at 4.9152MHz
RAM:	128K bytes, expandable to 256K
ROM:	2K bytes for Initial Program Loader
Keyboard:	104 typewriter style keys, numeric pad, definable keys and special functions keys
Display:	RGB monitor, 80 characters X 25 lines, 640 X 400 pixel graphics in eight colours (see text)
Interfaces:	RS232C serial port (110-9600 baud) light pen socket. Three expansion slots for optional devices.
Disk drives:	Two 20cm double-sided double density each providing 968K storage.
Peripherals:	Built-in 80cps full-size dot matrix printer.
Documentation:	Separate manuals on hardware, Basic and CP/M. Manuals well organised but lack detail.

OKI if800 Basic statements

ABS, ASC, ATN, ATTR\$(disk), AUTO, BEEP, BLOAD, CALL, CDBL, CHAIN, CHR\$, CINT, CIRCLE, CLEAR, CLOSE, CLS, COLOR, COM OFF, COM ON, COM STOP, COMMON, CONSOLE, CONT, COPY, COS, CSNG, CSRLIN, CVI, CVS, CVD, DATA, DATE, DATES\$, DAY, DAY\$, DEF CHR\$, DEF FN, DEF USR, DEFINT/SNG/DBL/STR, DELETE, DIM, DIM@, DRAW, DUMP, EDIT, END, EOF(disk), ERASE, ERL, ERR, ERROR, EXP, FIELD(disk), GET@, GOSUB . . . RETURN, GOTO, HEX\$, IF . . . THEN . . . ELSE, INKEY\$, INP, INPUT, INPUT (disk), INST, INT, KEY, KEY LIST, KEY OFF, KEY ON, KEY STOP, KILL(disk), LEFT\$, LEN, LET, LFILES(disk), LINE, LINE INPUT, LINE INPUT (disk), LIST, LLIST, LOAD(disk), LOC(disk), LOCATE, LOF(disk), LOG, LPOS, LPRINT, LPRINT USING, LSET(disk), MDI\$(disk) MERGE(disk), MID\$, MKD\$(disk), MKS\$(disk), NAME(disk), NEW, OCT\$, ON . . . COM GOSUB, ON ERROR GOTO, ON KEY GOSUB, ON PEN GOSUB, ON . . . GOSUB, ON . . . GOTO, OPEN(disk), OPEN(port), OPTION BASE, OUT, PAINT, PAUSE, PEEK, PEN(n), PEN OFF, PEN ON, PEN STOP, PLAY, POINT, POKE, POS, PRINT, PRINT USING, PRINT (disk), PRINT USING(disk), PSET, PRESET, PUT(disk), PUT@, RANDOMIZE, READ, REM, RENUM, RESET, RESTORE, RESUME, RIGHT!, RND, RSET(disk), RUN, SAVE(disk), SCALE, SCREEN, SELECT, SET, SET(disk), SGN, SIN, SPACE\$, SPC, SQR, STOP, STR\$, STRING\$, SWAP, SYMBOL, SYSTEM, TAB, TAN, TERM, TIME, TIME\$, TRON/TROFF, USR, VAL, VAPRTR, WAIT, WHILE/WEND, WIDTH, WIDTH LPRINT, WRITE.

Enhanced CP/M

CP/M (Control Program for Microcomputers) is an operating system written by Digital Research to run on the 8080 microprocessor. It is organised in such a way that only a small section of the program (the BIOS, or Basic Input/Output System) is dependent on the configuration of any one machine. All other functions are implemented with calls to this system, allowing CP/M programs to be used by a large number of machines.

Many thousands of applications programs are available from commercial and private suppliers which will, in theory, run on any system using CP/M.

In practice a major obstacle to the interchange of CP/M programs between different computers is the variation in disk formats used to store data on disks. Although a standard format exists for 20cm disks (the IBM 3740 format), each manufacturer of systems using 13cm disk

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drives tends to use a different data storage format, so that disks written on one system cannot be read by a system with a different brand name.

The if800's 20cm disk drives can be configured to be fully compatible with the 3740 format, so that these problems do not arise.

Oki supplies an extended version of CP/M with the if800 Model 30. While compatible with CP/M 2.2 this version of the operating system incorporates other functions to take advantage of the special features of the if800 system. What this means is that standard CP/M programs will run on the if800, but programs written using the special features of Oki's CP/M cannot be run on systems which lack these features.

The extended features of IF-CP/M allow the programmer to access graphics, the in-built printer, screen format routines, RS232C port and optional Centronics port, ROM cartridge and light pen directly from CP/M or any other program running under CP/M. Function keys and the extended "bank select" memory arrangement of the if800 can also be fully utilised and a number of disk utility programs provide further capabilities.

Access to the graphics features of the if800 is an exceptional feature of IF-CP/M. Many other systems provide graphics capabilities which can only be accessed through Basic, making them unusable by other programming languages and applications programs.

Two methods are available to allow the user to add graphics to programs running under CP/M on the if800. The first method uses Escape key sequences to indicate that graphics commands and parameters follow. To draw a circle under CP/M, for example, the command is ESC G C, Colour, Centre X, Centre Y, Radius, where the four parameters are expressed as decimal numbers. Ellipses, arcs, line and boxes can be drawn and coloured with variations on this technique.

The second method of accessing graphics is faster but less general-purpose. Direct calls to the BIOS routines of Oki's extended CP/M are permitted, allowing graphics to be added to any program. This method requires some experience of assembly language programming but allows fast, versatile access to all graphics functions.

A number of utility functions of the on the Oki system disk further expand the usefulness of the if800. IFCONFIG allows the selection of parameters for the RS232C port and an external printer which may be connected to either the



This view shows the if800 with an on-screen self-portrait.

serial port or via the optional Centronics interface. Another utility, 20T030, allows programs stored on the 13cm disks used with the Oki Model 20 to be transferred to the 20cm disks of the Model 30.

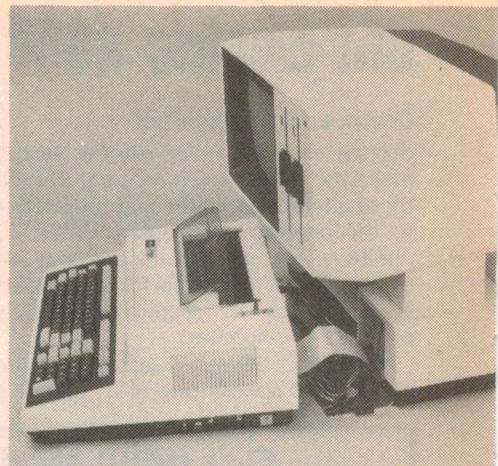
A utility called MDDUTY can be used to create a "memory disk" using the colour graphics memory or the extended memory provided by a memory expansion board. Using this utility a section of memory of up to 192K bytes can be configured so that it appears to the system as a very fast disk drive.

The advantage of this approach is that programs which require frequent disk accesses can operate on the "memory disk", considerably increasing the speed of execution. Compilers, database programs and word processing programs in particular can make good use of this feature. While most other S100 CP/M systems can be fitted with a "memory disk" it is usually a costly optional feature.

Applications

Given the standard CP/M format of the if800 disk drives, applications programs for the system should be readily available, although some customisation would be required to take full advantage of the if800's features. WordStar and Spellbinder word processing programs are available, as is the spreadsheet calculator SuperCalc and a host of other programs from dealers and organisations such as the CP/M Users Group.

We ran Spellbinder, a full-featured easy-to-use word processor. Using this program shows up a possible disadvantage of the if800. The bit-mapped colour display and long persistence phosphor means that screen updates take an appreciable amount of time. Since



The two parts are joined by three cable connectors and bolted together.

Spellbinder (and to a lesser extent, WordStar) reformat the screen as new characters are entered or inserted, for a great deal of the time what's on the screen has no relationship to what is being typed – an annoying peculiarity.

To some extent the problem is inherent in the design of the if800, in that colour graphics and text processing make different demands on a system. While the colour version of the if800 is excellent for graphics it is not ideal for processing large amounts of text. Those considering such applications would perhaps be better advised to look at the monochrome version of the if800.

Conclusions

We have some reservations about the if800. With its expanded memory and fast Z80B microprocessor, plus colour graphics, the machine is an excellent implementation of a CP/M system. In these days of 16-bit microprocessors however, CP/M, while maintaining a large and loyal following, can hardly be described as "state of the art".

Other reservations arise from the "all in one" configuration. Perhaps the if800 does take up no more space than an equivalent modular system with separate printer and disk drives, and the lack of cabling is a definite advantage, however the if800 presents itself as a big, bulky and noisy system. The height of the keyboard and the fixed position of the display are also incompatible with current thinking on ergonomic design standards.

Cost of the system reviewed here is \$5650 plus sales tax. Included in the price is the CP/M operating system, OBasic interpreter, WordStar word processing program, SpellStar, Mailmerge and the CalcStar electronic spreadsheet program.

For further information contact Sigma Data Corporation Pty Ltd, 157 Walker St, North Sydney, NSW, 2060, phone (02) 436 3777.

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See page 98 for full address details

A606/TH

New concept in energy management

Remote control for lights and appliances

Remote control of lighting and other appliances from a central point offers convenience, security and energy savings for the office manager or factory supervisor. Until recently however such a system was difficult to install, requiring extensive re-cabling of buildings. A new product on the Australian market, "Ripul" mains carrier switching, offers all these advantages and more, using simple controllers that plug into any mains electricity outlet.

Ripul is the trade name for a method of superimposing a carrier signal on the mains electricity supply to remotely control lights and other appliances. Using the existing mains wiring and Ripul control units, appliances can be switched on and off or lights dimmed under the control of a handheld infrared transmitter or a programmable timer, over wiring distances of up to 2000 metres.

Applications for the system include energy management, security, household control and aid for the physically handicapped.

The Ripul system uses a pulsed 140kHz carrier signal which is switched on and off to convey information in a binary code. The first pulse indicates that an "address" or channel number follows and the four subsequent bits of the code select one of 16 possible receivers. Appliances connected to the receiver can either be switched on and off or controlled proportionally, depending on the type of receiver in use.

Expansion of the coding system is possible to allow a maximum of 600 channels on each phase of the mains supply — a total of 1800 independently controlled switching functions.

Some of the components of the system are shown in the accompanying photographs. From the user's point of view the most visible piece of equipment is the handheld infrared remote controller. The compact control unit transmits an infrared signal to "senders" plugged into the mains. Available units include 16-channel, four channel and single channel versions, all completely self-contained and battery powered. Power is only consumed when the controller is actually sending a signal, so the life of the calculator-type battery of the

unit is a claimed two years.

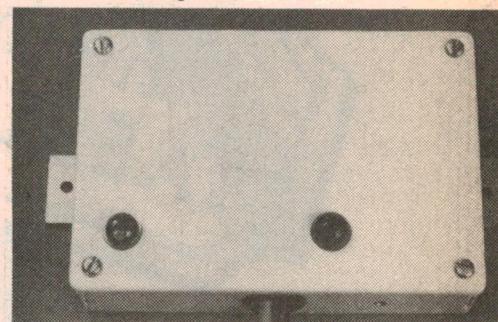
In addition to handheld controllers, Ripul equipment can be coupled to a programmable timer or computer to allow switching of appliances according to a preset schedule. The standard timer offers four control channels and timing up to seven days in advance, with one minute accuracy. A 14 channel model is also available which will time events up to a year in advance.

Several different types of "sender" are available. These receive the signal from the infrared controller and produce the appropriate sequence of 140kHz pulses to activate the selected receiver. Probably the most commonly used sender is the plug-in version, a small rectangular device with a lens for the infrared detector and a one metre mains cord. Installation is simply a matter of plugging the unit into a convenient mains socket.

An outdoor model is also available in a tough weatherproof polycarbonate case. Installation requires connections to the active and neutral lines of the mains supply. Using this sender, signals from an infrared controller outside a building can be used to control internal or external lights and appliances. With one of these units and suitable receivers installed in the home a driver could turn into the driveway, open the garage door, switch on the interior and exterior lights, turn up the heat and perhaps get dinner under way before even stepping from his car!

There are several different types of Ripul control receivers. The portable 16-channel switch is perhaps the most commonly used. This version has a 16 position rotary switch which selects which address the receiver will respond to and two pushbuttons for manual con-

by PETER VERNON



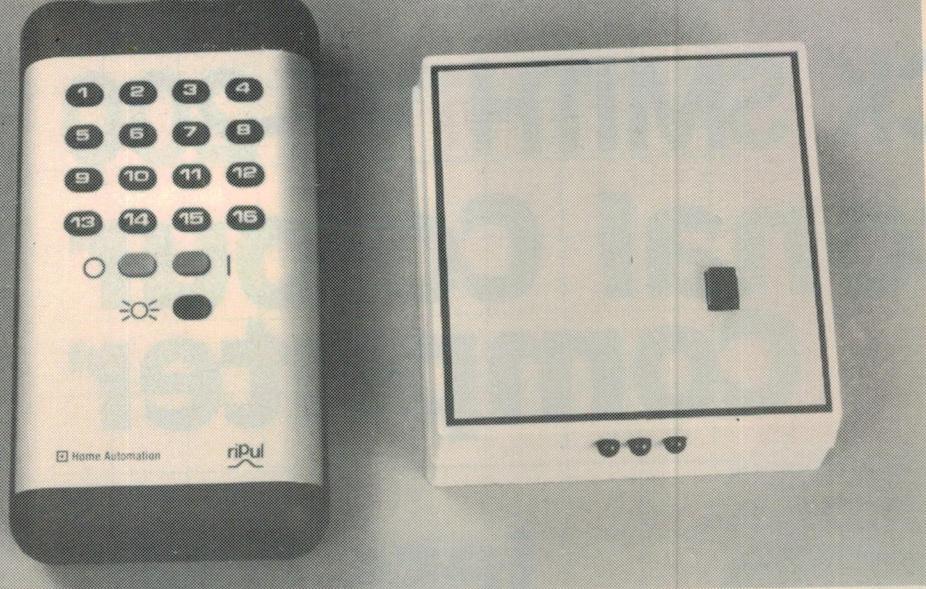
trol of the switch function. It is supplied with two integral power cords, one of which plugs into a mains socket for reception of control signals and the other containing an "in-line" socket to accept the plug of the appliance to be controlled.

The most straightforward receiver simply provides on/off control for loads of up to 1500W, but specialised types are also available for heavier loads and for dimming lights. When used for the dimmer mode, a touch of a button on the handheld controller causes the light to dim until the button is released. Lights can also be turned off or on at a preset brightness level.

The standard light dimmer receiver has a rating of 1A at 240V, but heavy duty versions are available for controlling incandescent lighting of up to 3kW or fluorescent arrays of up to 1.5kW. A 66kW (25kW for fluorescent fittings) version of the dimmer switch is also available.

For use with such a dimmer, fluorescent lights must be fitted with a "dimmable" ballast and a heater to ensure that the tube "strikes" at low settings of the dimmer.

Receivers for lighting control can also be fitted with a photocell which detects the amount of ambient illumination in an area and switches off the light when natural illumination exceeds a preset level. When coupled with central control from a programmable timer, local control via an infrared transmitter and an over-riding touch switch this system



ABOVE:
16-channel
hand-held
remote control
unit (left) and
touch-sensitive
wall mounting
unit (right).

LEFT: this ceiling
mount unit combines
infrared control
with an ambient
light sensor.

RIGHT: single
channel IR
receiver/sender
(left) and
16-channel IR
receiver/sender.

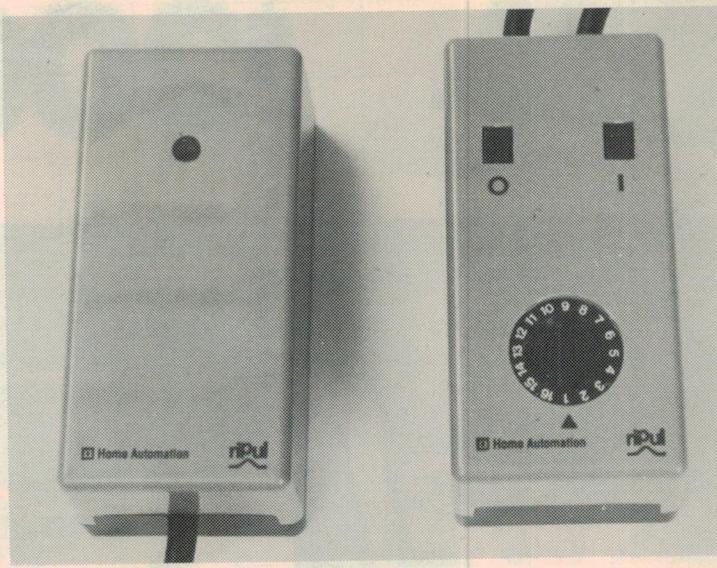
forms a flexible, responsive lighting control system which can offer considerable savings in power bills.

Energy conservation

Conserving energy is a matter of using power only when and where it is needed. According to authorities, lighting in commercial buildings should be switched on only when each individual needs more light than is available at the time, rather than the more common "blanket" approach. As individuals move around or alter their schedule the lighting pattern should immediately respond to the changed circumstances.

This degree of energy management requires a highly flexible control system which is responsive to need but also convenient to work with. The answer, according to Ripul is not a large and laboriously pre-programmed computer, but a combination of local manual control with time switching and ambient light sensing.

A local receiver added to each light fitting or group of lights controls illumination in response to signals from a central timer and also from a hand-held or wall



mounted local controller available to each individual. Ambient light sensing is also incorporated. Power bill savings arise from four aspects of the system; lights are switched on only when actually needed and switched off when ambient light rises above a preset level. Lights can also be turned off after the expiry of a time lag so that unoccupied offices are not illuminated, and a central control timer ensures that lights are not left on overnight.

With only minor alterations the same system can be applied to the control of heating and air-conditioning equipment, allowing further energy savings.

Trials of such installations both here and in the UK have demonstrated energy savings of from 15 to 35%, which means that the required Ripul equipment pays for itself in around two years, according to the manufacturers.

Apart from energy conservation a major application of the Ripul controllers is in the security field. A central sender can allow a security guard to remotely control the lighting in any part of a building. Usually this approach is combined with closed circuit television monitoring for a

cost-effective surveillance system which does not require constant illumination.

Other applications of the equipment involve sending messages to either audible or visual indicators. Lloyds of London, for example, has installed Ripul systems in the offices of senior staff to activate an "engage" light outside each office door as well as control office lighting. A number of hotels have also installed the system to allow guests to signal for room service. The advantage here is that no additional wiring is required — the existing mains wiring carries the service request signals as well as power.

Easy, low-cost installation is one of the most frequently cited advantages of Ripul systems. Since the units simply plug in to existing mains wiring there is no need for expensive special cabling and the consequent re-decorating required by control systems which use separate wires. Architects working on the restoration of historic buildings in particular have specified Ripul control to avoid the need for disturbance created by new cable runs and conduits.

Some customers in fact claim that the ease of installation of Ripul systems has meant that they can add energy management and control functions for the same price as a less comprehensive system which requires special cable runs.

Domestic use

Lighting Energy Systems, the distributors of Ripul products in Australia, has concentrated mainly on industrial and commercial installations. Price is one factor, but more importantly the Ripul system can in fact be too far-reaching.

While the 2000 metre carrying range of the senders is an advantage in a large building it could cause problems if a number of systems are installed in dwellings. Switching lights on and off in your own house may also switch Ripul controlled appliances in your neighbour's house — a situation guaranteed to cause some domestic friction!

Fortunately there is a way out, in the form of a filter which is installed in the household junction box, eliminating the possibility of interference between adjacent Ripul installations.

Ripul switching in private houses is not common, however. Far more interest has been shown by major industrial and commercial organisations and a number of successful installations are currently operating in Sydney, with many more planned.

Ripul equipment is manufactured in England, and imported in bare board form by Sydney company, Lighting Energy Systems, who assemble and install the systems. For further information contact the company at 1 Leighton Place, Hornsby, NSW 2077. Phone (02) 476 1199.

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(May 1983 issue, Australian Personal Computer)

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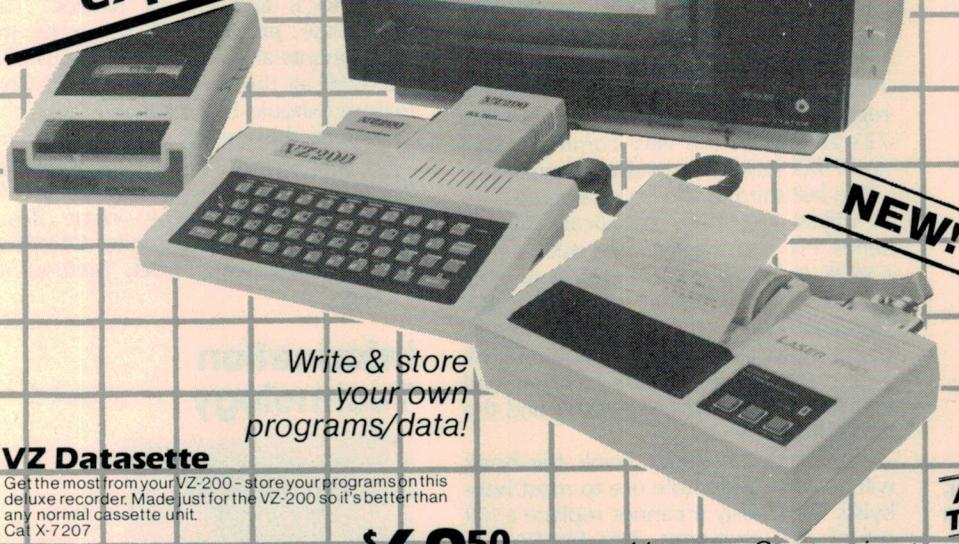
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NOTE: Some programs may require 16K memory module.

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Books & Literature

Semiconductor Data and Applications



DICK SMITH'S AUSTRALIAN SEMICONDUCTOR DATA AND APPLICATIONS BOOK. Published by Dick Smith Management Pty Ltd, 1983. Soft covers, 127 pages, 210 x 140mm. Illustrated with many circuit diagrams and device connections. ISBN 0 949772 07 0. Price \$7.95.

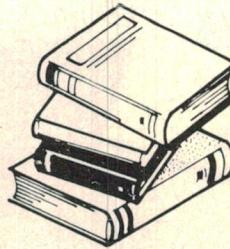
This book, one of the Dick Smith range of publications, is designed as a reference book for hobbyists. It provides pinout and circuit diagrams for many common semiconductor devices as well as background theory and information essential for understanding how many of today's devices and circuits work.

Several types of diodes are covered in the book, these being small signal diodes, rectifier diodes, zener diodes, light emitting diodes and photosensitive diodes. Included in the light emitting diodes (LEDs) are sections on seven segment displays and infrared LEDs.

Transistors are covered in several sections with specifications being given for some of the most commonly used devices in bipolar, unijunction and field effect transistors.

Sections are also included on silicon controlled rectifiers (SCR's) and Triacs with specifications and circuits shown for the more common devices.

Operational amplifiers (op amps) which are covered include the 741 and 301, the CA3130 and CA3140 (FET input) and the 3080 (transconductance amplifier). A surprising omission from the operational amplifier sections is data for the TL071-TL074 series of op amps which are used quite extensively these days.



Both data and circuits are provided for the well known 555 timer IC and a section has also been provided for the 7555, the CMOS version of the 555.

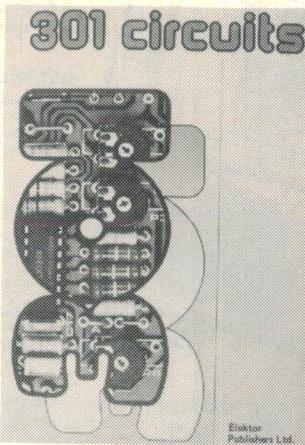
Data is also provided on voltage regulator ICs and includes the adjustable 723 as well as the very common 78XX and 79XX series fixed voltage regulators.

The last third of the book is given over to digital ICs, more specifically the 74 series TTL and the 74C and 4000 series CMOS. Included are sections on suitable power supplies, interfacing between the two logic types, and static protection of the 4000 series CMOS. A very brief look at the 74C series CMOS is given and comparison made between this and the 4000 series CMOS.

Overall, as a first data book, this book will be of considerable use to most hobbyists. Obviously it cannot replace a full set of manufacturer's data books, but then it does not cost several hundred dollars.

Our review copy came from Dick Smith Pty Ltd and is available from any of the Australian Dick Smith stores. (JS)

301 Circuits by "Elektor"



301 CIRCUITS. Published 1983 by Elektor Publishers Ltd, Canterbury. Printed in the Netherlands. Soft covers, 140 x 210mm, 342 pages, illustrated with many circuit diagrams. ISBN 0 905705 12 2. \$12.75.

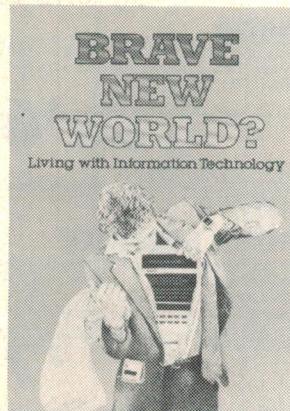
As can be gathered from the title, this is a collection of 301 circuits which have been published previously in "Elektor" magazine. Most of the circuits can be characterised as having no more than

two or three IC's and just a few other parts. Some of the circuits use only one IC or transistor. And most of the circuits appear to have been produced by contributors to the magazine rather than by magazine's staff.

Some 35 of the circuits are published with actual size artwork for a printed circuit board. This artwork is to the usual high "Elektor" standard, ie neat and geometrical and closely packed. This may pose problems if some of the components are unavailable in Australia although all the semiconductor devices featured should be obtainable here.

Most of the circuits are intended for battery operation and a quick perusal of the books indicates that they all should be viable. Our copy came from Technical Book & Magazine Company Ltd, 295 Swanston Street, Melbourne. (L.D.S.)

Information Technology



BRAVE NEW WORLD: Living with Information Technology. Published by McDonald & Co, London, 1982. Soft covers, 147 x 211mm, 174 pages ISBN 0 356 09178 3. Price \$12.95.

This book is a collection of essays on the impact of information technology, or IT as the British say. Eleven eminent journalists, businessmen and educators have each contributed a chapter on the applications and effects of automated information handling in their fields. Kenneth Baker, the British Minister for Information Technology (the Minister for IT?) wrote the brief preface.

The individual essays cover a wide range of subjects in four broad areas. Peter Large, of the London Guardian, and Alan Cane of the Financial Times provide overviews of the effects and potential of information technology and a number of industrialists contribute chapters on the applications of technology in engineering design, manufacturing, retailing, finance and office administration.

Part Three of the book covers wider

topics; mass communications, social and economic implications and the prospects for education. David Fairbairn, the director of the UK National Computing Centre Ltd provides the final section, bringing the reader back down to earth with a "practical guide" to computer equipment currently available.

The problem with all books of this kind is that in covering such a wide area as information technology they can necessarily only touch briefly on each particular subject. While providing an overview they can be short on detail or just plain wrong (as in the glossary entry in this book which defines APL as "A program language which needs little or no previous computing knowledge". That may be true if you already have a degree in mathematics, but can only mislead those unfamiliar with the language).

Fortunately slips such as that are rare in this book. The general approach is balanced and the material is written by contributors who obviously know the fields of which they write. The material is both understandable and thought provoking, and altogether a most readable introduction to the perils and potential of information technology. Our review copy was supplied by MacDonald Futura Australia, 19a Boundary St, Rushcutters Bay, NSW 2011 (PV).

1983 Radio and Television Handbook

1983 WORLD RADIO & TELEVISION HANDBOOK published by the World Radio & Television Handbook Company, Copenhagen, Denmark, 37th Edition 608 pages, soft cover, 146 x 228mm.

The World Radio & Television Handbook has been published from Copenhagen for 37 years. It was first conceived by O. Lund Johansen who published the Handbook in 1946 when it covered less than 100 pages. Today the World Radio & Television Handbook, covering more than 600 pages gives complete details of all the world's radio and television stations. They are listed in countries by continental groupings and then medium and shortwave stations are listed by frequency. The Australian, New Zealand and South Pacific section had been completely updated and rewritten thanks to collaboration by readers in Australia and New Zealand who have gone through the last World Radio & Television Handbook thoroughly to ensure that this section is as accurate as possible.

The Handbook has continued to expand its information and many new countries appear in the 1983 edition for the first time. In the section "Listen to the World", Lawrence Magne reviews many of the popular portable communication

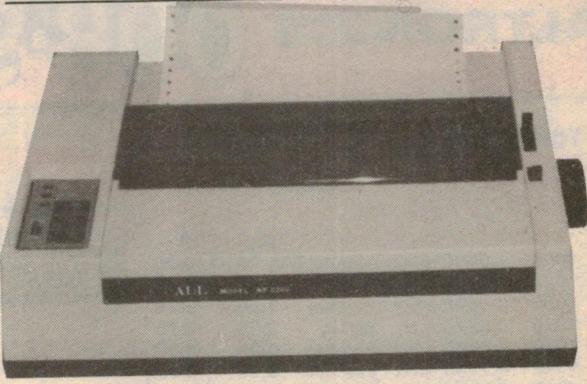
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receivers which have taken the listening world by storm in recent months. These include the ICOM IC-R70, Sony ICF-6800W, Trio-Kenwood R-600, National Panasonic DR-31 and many more receivers from leading world manufacturers. The section gives background information needed when one is considering purchasing a new receiver. Other features sections include Yachting and Shortwave Radio, the High Fidelity Future of Shortwave and Mediumwave AM Radio. The Red Cross Broadcasting Service, Radio in Nicaragua etc - altogether 43 pages of interesting reading.

The World Radio & Television Handbook had long been regarded as

the only directory of international broadcasting sold throughout the world. The United States Information Agency has put copies into its libraries in 71 countries so that those in third-world countries who cannot afford the book will have access to its information. The Editor J. M. Frost, and Assistant Editor A. G. Sennitt, are to be congratulated on the painstaking work involved in compiling another excellent edition of the Handbook. Readers in Australia and New Zealand should find copies at their bookseller this month, or they can write to the sole New Zealand agent, Arthur Cussen, 212 Earn Street, Invercargill, New Zealand for further information. (A.T.C.)

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Y 1003	1.8432 mHz	Parallel	9.50	8.75	
Y 1006	2.0000 mHz	Parallel	7.50	6.75	
Y 1010	3.5875 mHz	Series	3.00	2.75	
Y 1012	4.0000 mHz	Parallel	5.00	4.50	
Y 1015	4.1940 mHz	Parallel	5.00	4.50	
Y 1017	5.0000 mHz	Parallel	5.00	4.50	
Y 1018	6.0000 mHz	Series	5.00	4.50	
Y 1019	8.0000 mHz	Series	5.00	4.50	
Y 1020	10.0000 mHz	Series	5.00	4.50	
Y 1025	12.0000 mHz	Series	5.00	4.50	
Y 1030	16.0000 mHz	Series	5.00	4.50	

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Heat conducting paste facilitates heat transfer from semi to Heatsink. One tube good for up to 30 TO3 package semiconductors.



H 1600...7.5g Pack.....\$1.20
New trade pack
H 1610...150g Pack.....\$7.50
SAVE UP TO 33%

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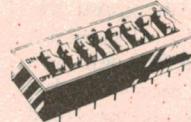


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H 0500.....\$3.50 per sheet

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S 3060
8 Way \$2.00 \$1.75

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Features • X-Y Operation • Vertical sensitivity 1mV/div. • 10 x Sweep time magnification with 1-touch operation • Convenient CH1 signal DVM output • Z-axis input provided — possible to use as CRT display • 0.2us to 0.2s — wide sweep range setting • Five modes of vertical operation • Panel layout with colour coding of respective functions.

• Vertical deflection Sensitivity	AUTO, NORM, TV (+), TV (-) CH1, CH2, LINE, EXT AC
5mV/div to 5V/div - 5%	10 calibrated steps
1mV/div to 1V/div - 6%	1mV/div to 10V/div - 6%
(When using x5 amplifier)	Uncalibrated continuous control between steps 1 - 25 (provided with click positioning function)
Bandwidth	DC to 15MHz -3dB (at 4div) DC to 7MHz -3dB (at 4div) (When using x5 amplifier) 24ns (for x5, 70ns typ)
Rise time Signal delay line	5mV/div to 5V/div
Max. input voltage	600Vp-p or 300V DC - AC peak, at 10V/div
Input Coupling	AC, GND, DC
Input impedance	Direct 1M ohm approx 30pF
Operating modes	CH1, CH2, DUAL, ADD, DIFF
X-Y operation	CH1, X-axis, CH2, Y-axis
Sensitivity	5mV/div to 5V/div
Phase difference	DC to 10kHz within 3
X bandwidth	DC to 500kHz -3dB
Dynamic range	4div or more
CH1 output	20mV/div or more
Output voltage	Amplified into 50Ω
Band width	50Hz to 5MHz -3dB
Output impedance	Approx. 50Ω

AUTO low bandwidth	Input impedance approx 1M ohm, 30pF or less
Trigger slope	Max. input voltage 100V
External trigger input	[DC + AC peak, at 1kHz] 2div/div to 0.2div -5%
Sweep time	19 calibrated steps Uncalibrated continuous control between steps 1 - 25 (provided with click-positioning function)
Sweep time magnifier	10 times (-7%)
Max. sweep time	100ns/div (20ns/div and 50ns/div, not calibrated)

• Amplitude calibrator Waveform	Approx. 1kHz -10% (typ), square wave
Voltage	0.5V -5%
• Power requirements	100/120/220/240V -10% 50 to 60 Hz, approx. 40W
• Dimensions	Approx. 275(W) x 190(H) x 400(D)mm
• Weight	Approx. 8.5kg

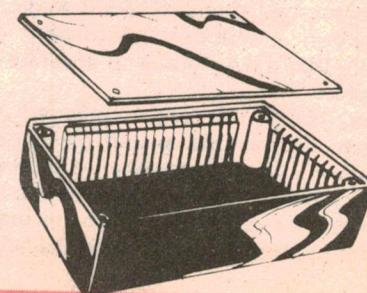
SPECIFICATIONS

Vertical deflection
Sensitivity
5mV/div to 5V/div - 5%
10 calibrated steps
1mV/div to 1V/div - 6%
(When using x5 amplifier)
Uncalibrated continuous control between steps 1 - 25 (provided with click positioning function)
Bandwidth
DC to 15MHz -3dB (at 4div)
DC to 7MHz -3dB (at 4div)
(When using x5 amplifier)
24ns (for x5, 70ns typ)
Rise time
Signal delay line
Max. input voltage
600Vp-p or 300V DC - AC peak, at 10V/div
Input Coupling
AC, GND, DC
Input impedance
Direct 1M ohm approx 30pF
Operating modes
CH1, CH2, DUAL, ADD, DIFF
X-Y operation
Sensitivity
5mV/div to 5V/div
(When using x5 amplifier)
Phase difference
DC to 10kHz within 3
X bandwidth
DC to 500kHz -3dB
Dynamic range
4div or more
CH1 output
Output voltage
20mV/div or more
Band width
Amplified into 50Ω
Output impedance
Approx. 50Ω

Incredible offer!

Black plastic body with 22 g. aluminium lid and 4 st. screws supplied. Unique horizontal PC "Snap In" mounts as well as vertical card guides. Order your PC Boards presized and dispense with costly stand offs, screws etc. These utility boxes are used in dozens of E.T.I. and E.A. projects.

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H 0101	150 x 90 x 50	90	87	\$1.90
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H 0105	83 x 54 x 28	50	47	\$1.20



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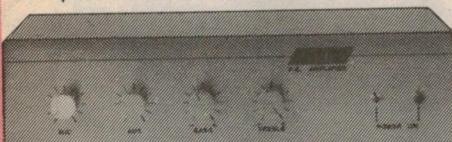
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The AS-20 is a rugged, reliable general purpose public address amplifier. Designed and manufactured in Australia this amp is suitable for use by schools, sporting clubs, function centres and in professional installations (paging systems, background music).

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200mm (8 in.). 10 Watts Max. power input. Public Address, Background Music. Ideal Hi Fi extension speaker. Includes transformer holes at 51mm. Over 30,000 sold in Australia!

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MOTOROLA CMOS DATA

B 1105.....\$11.50

A comprehensive reference covering 40XX, 45XX CMOS family's along with specialty devices such as LCD drivers, telephone and general communication functions and industrial control. 862 pages essential in all spheres of electronics.



MOTOROLA MECL DATA

B 1100.....\$9.95

Emitter Collector Logic (ECL) is today's fastest form of digital logic providing the most direct way of improving system performance. This previously hard to get manual provides data on the 10KH, 10K and III families, MECL memory and PLL CHIPS.



MOTOROLA OPTO DATA

B 1118.....\$8.95

Handy reference provides data and application notes on opto couplers, infra red LEDs, Photo transistors and a complete chapter on fibre Optics, a communications system which is fast gaining usage worldwide. VERY EDUCATIONAL.

MOTOROLA POWER DATA

B 1101.....\$12.95

Motorola are the undisputed world leader in Power Transistors. Renowned for their low cost and reliability. Book includes a 9 page selection guide, application notes and Data Sheets for over 700 devices. 989 pages. Previously over \$20.00.

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Has tapered low frequency response for articulate speech reproduction. Low impedance balance line. PTT switch with lock facility. Additional switch contacts for remote switching, muting etc. Gooseneck approx. 350mm.

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Multitap inbuilt line transformer allows taps 330/30W, 660/15W, 1000/10W, 2000/5W. Universal swivel mounting bracket supplied.

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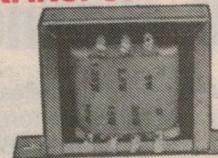
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20W HIGH POWER
SPEAKER TRANSFORMER

Primary Power Taps (100V
Line) 1.25/2.5/5/10/15/20W
(Halve these for 70V line)
Secondary Taps 4/8/16 OHMS.

M1120.....\$10.80

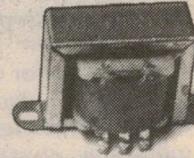
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4W MULTI-PURPOSE
SPEAKER TRANSFORMER

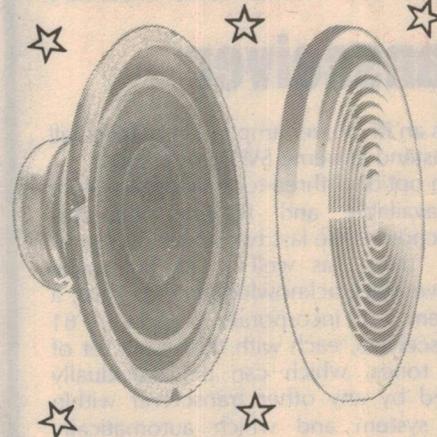
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Over 1200 pages covering all aspects of Motorola's microprocessor, microcomputer and peripheral components. A clearly written Manual providing all the data necessary to design and build a working computer system from scratch. 100's of circuit examples, flow charts, Truth Tables and programme routines.

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Popular data manual. At last readily available. Approx. 800 pages, full Data Design procedures and equivalent listings for 1000's of devices under headings of AMPS, VOLTAGE REGULATORS, CONSUMERS CIRCUITS (eg. TV, AUTOMOTIVE, POWER), HIGH FREQUENCY CIRCUITS and SPECIAL-PURPOSE CIRCUITS.

MOTOROLA LINEAR INTERFACE IC'S

B 1115.....\$11.50

Complements the Linear IC Manual. Gives data, design procedures and equivalent listings for: MEMORY / MICROPROCESSOR SUPPORT, LINE DRIVERS / RECEIVERS, TELEPHONY, COMPARATORS, VOLTAGE REFERENCE AND DATA CONVERSION DEVICES. Includes comprehensive selector guide.



SCHOTTKY TTL DATA

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Essential reference for the enthusiast and engineer alike. Designing, building and developing digital circuitry is an absorbing pastime. Data on Schottky TTL, AUS and FAST families, along with design considerations and circuit characteristics are logically presented in this manual, making it quick and easy to use.

New Products...

Product reviews, releases & services



40 channel UHF transceiver

Imark Pty Ltd has released a new UHF transceiver, the Sawtron 990, to replace the popular Sawtron 880 UHF CB. The Sawtron 990 is compact and will fit in the smallest DIN size radio apertures in vehicle dashboards. The control head can be mounted separately from the transceiver section. This makes the Sawtron 990 ideal for compact vehicles.

The receiver uses the double conversion superheterodyne method, two monolithic crystal filters, and two ceramic filters to ensure excellent sensitivity, selectivity, and immunity to signals on the image and adjacent channel frequencies. The transmitter

uses an RF power amplifier IC which will withstand extreme SWR conditions.

An optional three-tone Selcall system is available and features operator selection of the last two tones (ie, "tens" and "units") as well as an automatic answer-back acknowledgement. Thus, a system can incorporate a total of 81 transceivers, each with their own set of call tones, which can be individually called by any other transceiver within the system and which automatically acknowledges receipt of the call.

Further information from Imark Pty Ltd, 167 Roden Street, West Melbourne, 3003. Phone (03) 329 5433.

A new frequency counter

A new frequency counter offering high performance, ease of operation and measurement flexibility from 5Hz to 650MHz has also been introduced by Global Specialties.

The new Model 6000 incorporates an easy-to-read eight digit LED display and simple push button controls with LED indicators for selecting the input, gate time, and low-pass filter.

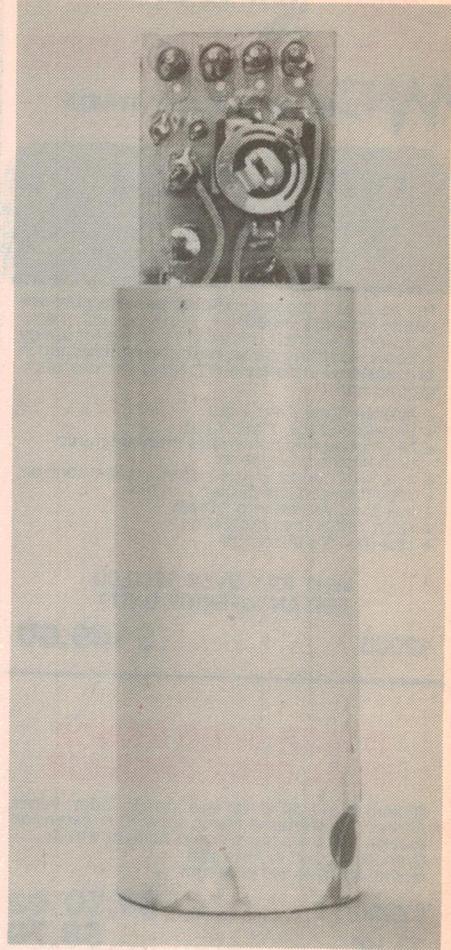
Two front-panel BNC inputs are provided: one covering the rate 5Hz to 100MHz with a $1\text{M}\Omega$ input impedance and the other for signals between 40MHz and 650MHz with a

50Ω impedance. Gate times of 0.1, 1.0 and 10 seconds are available, and a switchable low-pass filter provides 3dB/octave rolloff at 60kHz for audio and ultrasonic measurements.

The standard Model 6000 incorporates a 3.579545MHz temperature-compensated crystal oscillator with an accuracy of ± 1 part in 10^6 . An alternative high-stability version, the Model 6500, features a crystal oven oscillator with an accuracy of ± 1 part in 10^7 .

The instrument is compact (76 x 254 x 178mm) and lightweight (1.6kg), and features a flip-up leg for benchtop use.

Global Specialties products are distributed in Australia by Vicom International Pty Ltd.



FM transmitter module

Transmitting on the 88-108MHz band, this FM transmitter module is suitable for applications requiring a high quality wireless link. Constructed on a small printed circuit board the unit is partially potted into a 25mm diameter plastic tube. One end is left protruding so that the power, antenna and audio inputs can be connected. Overall length is 90mm.

The transmitting frequency can be adjusted and the usable transmitter range is up to 50 metres. Frequency response is claimed to be from 20Hz to 15kHz and the input sensitivity is adjustable to a maximum of 30mV. The noise output is very low at -60dB. Pre-emphasis is set at 50us. The unit is claimed to have good frequency stability however no specifications are given for this. Power requirements are a DC voltage of between 6 and 9 volts at 20mA.

This unit is available from Jaycar, and price is \$49.95.

Full instructions are supplied with the unit, providing information on the input connections and adjustments for transmission frequency and input sensitivity.

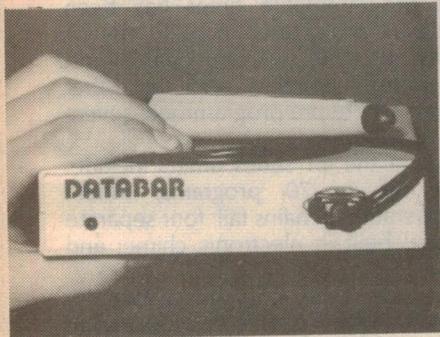
Mini bar code reader

Nortronic Instruments has released a new compact bar code reader. The Databar Model 402 Reader is provided with dual RS232 communications to allow easy and flexible connection to most asynchronous serial terminals. All commonly used bar codes are supported, including Code 39, Interleaved 2 of 5, Codabar and APN.

When used with a video terminal, the reader is totally transparent to both the computer hardware and software, so that no programming changes are needed when a bar code reader is installed. A choice of hand held wands is available, optimised for high density code, medium density, or colour printed code.

Databar bar code readers are designed and manufactured in Australia and are used in libraries, hospitals, retail stores, and manufacturing plants where speed and accuracy of data entry is essential.

Further information from Nortronic Instruments, GPO Box 995, Sydney, 2000. Telephone (02) 290 2844.



Wind and Solar energy recorders

Measuring and Control Equipment Pty Ltd has recently released two new recorders for use in wind and solar energy research. The MACE DFR78-WND wind recorder and the MACE DFR78-SOL solar recorder are a further extension of the DFR77 and DFR78 range of meteorological and hydrological recorders which employ EPROM as the data recording medium. These recorders are capable of operating for several months without attention and are especially designed to operate in remote areas under harsh environmental conditions.

The DFR78-WND records from an anemometer and wind vane to log information on wind run and direction or

wind velocity. It is ideal for wind prospecting applications and airfield design studies in which long term measurement of wind distribution is of prime importance.

The DFR78-SOL operates from a Kipp & Zonen Pyranometer Solarimeter to record global solar radiation. The solarimeter output is directly connected to the recorder which has a very low drift DC instrumentation amplifier (typical temperature drift 0.02mV/°C) feeding a precision voltage to a frequency converter. The frequency output is counted in a register to obtain an integrated incident radiation reading which is logged by the recorder at predetermined time intervals.

Further details from Measuring & Control Equipment Co Pty Ltd, 2A Chester St, Epping, NSW, 2121. Phone (02) 86 4060.

SWITCH OF THE TO THE HOUSE FUTURE.

The totally programmable house is here! Now, for modest cost, you can control anything electrical in your home by remote control. From one chair, from your car, or even your bed you can switch anything and everything.

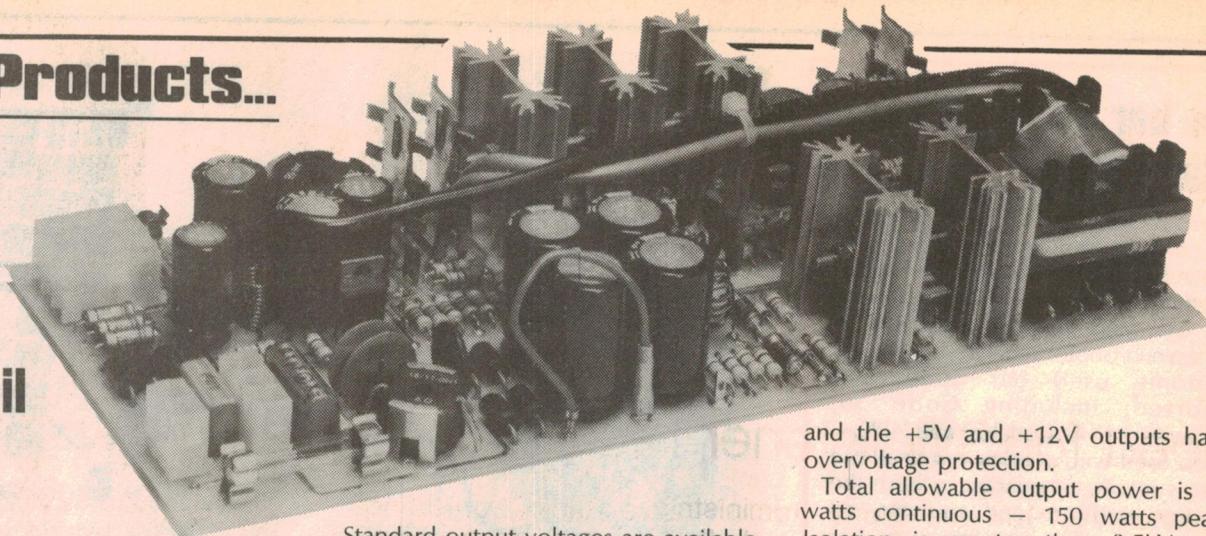
Switch on the TV downstairs, dim the light upstairs, open the garage door, start the oven, light up the pool, turn on the heat - without leaving your bed. Almost anything's possible with the new RIPUL Electronic Switching System. And it's easy to install.

The RIPUL System includes a remote control, a sender which plugs into the existing mains wiring at any ordinary power point, and as many receivers as you need. You press a button on the remote control, an infra-red signal is transmitted to the sender, which passes that signal through the mains wiring to the appropriate appliance. You can add a programmer for automatic control of everything in the house at set times - great for security. Find out how easily you can turn your home into the house of the future. Call RIPUL today.



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New Products...



Five rail power supply

Scientific Electronics have just released details of their newest power supply — the SM80AE1. Designed and manufactured by Scientific Electronics to meet Telecom specification 1302, this new five rail switchmode supply offers 80W total output and high reliability in a small package at a competitive price.

Standard output voltages are available as well as output rails to customer specifications. The five rails on the standard model are: +5V at 8A continuous; +12V at 2.5A continuous, 4A peak for 30s; +24V at 0.2A continuous, 2A peak for 30s; -5V at 0.5A continuous; and -12V at 1.0A continuous.

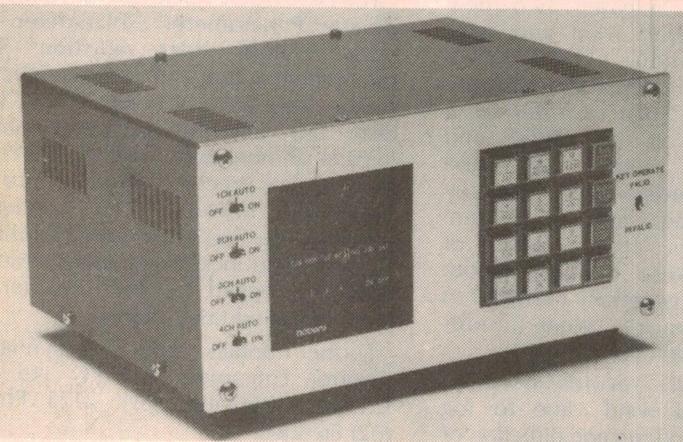
All outputs are short-circuit protected

and the +5V and +12V outputs have overvoltage protection.

Total allowable output power is 80 watts continuous — 150 watts peak. Isolation is greater than 3.5kV and efficiency greater than 60% full load.

The SM80AE1 measures 108 x 240 x 45mm and, as with all other power supplies from Scientific Electronics, is fully supported by a five year warranty and complete local technical back up.

Further information from Scientific Electronics, 6 Holloway Drive, Bayswater, Victoria. (03) 762 5777.



Seven-day timer

A new one week programmable timer has been released by Audio Telex. Manufactured in Japan, the CT series timers are ideally suited for switching bells, sirens, background music, sprinkler systems and the other multitude of applications where pre-programmed, seven-day time switching is required.

Some of the features of the CT series timers include: storage capacity of up to 70 programs; inbuilt rechargeable battery operation if mains fail; four separate control circuits; optional built in electronic chime; and affordable cost.

Further details from Audio Telex Communications Pty Ltd, 1 Little St, Parramatta, PO Box 421, NSW 2150. Phone (02) 633 4344.

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Shortwave Scene

by Arthur Cushen, MBE



Need for SW listener representative at WARC 84

In January, 1984 the World Administrative Radio Conference reconvenes in Geneva and will study the international shortwave bands, and their future. These decisions will be of major concern to all shortwave listeners.

The 1979 WARC meeting was significant as it affected all medium wave listeners throughout the world, except in the Americas, as all countries adopted a 9kHz spacing on medium wave which has now been implemented. The shortwave bands were also expanded with the creation of a new band and this is gradually being used.

It is of concern that the decisions made in January 1984 will affect the world wide shortwave audience and the consumer will have little input into the decision. The major fields of discussion will centre around the use of a single program on several frequencies in the one band, the extension of out-of-band broadcasting, the greater use of the tropical bands (60, 90 and 120m), and the increasing problem of jamming and deliberate interference.

During our monitoring of various bands, on a regular basis, we find that between 0200-0430UTC the 9MHz band is used by 106 stations sharing 55 frequencies. Sixteen are completely blocked by jamming, and 14 suffer severe side splatter, making 60% of this band unusable. Similar observations apply to the 6MHz band - 96 different signals were heard on 48 channels: 15 frequencies were jammed, and 10 suffered from sideband interference, making 50% of the band unusable.

The present broadcasting plan is based on theory when, four times each year, international stations make frequency adjustment due to seasonal changes. This plan for frequency sharing and co-operation is devised in Geneva but when the plan goes into effect the listener with years of listening experience is called on to sort out the co-channel interference. Poor frequency allocation means the listener has to try to get some resemblance of order so that he can enjoy clear reception.

No matter how high powered the transmitter, or the millions of dollars spent on equipment, studios, aerials, and top class programs, if the audience cannot hear an entertaining program they will abandon shortwave listening. The audience is the consumer in the field of international broadcasting and, at the World Administrative Radio Conference next year, it is hoped that some representation from the shortwave audience will be present to put forward their views to the international broadcasters. After all, the listener has a practical knowledge of frequency usage and the interference problem.

KNLS ALASKA

After months of preparation the first Alaskan shortwave station, KNLS, has commenced operation with gospel programming. The station has been heard on two frequencies - in Russian on 11820 up to 1200UTC, and from 1200 in Chinese-Mandarin on 9690kHz. The station closes in English at 1200UTC on 11820kHz.

The tests were first noted in July and the full tentative schedule of KNLS is 0900-1200 11820kHz in Russian; 1200-1330 9690 in Chinese-Mandarin; and 1330-1630 11820kHz in Russian.

HIGH FREQUENCY CUT

The BBC World Service is no longer using 25650kHz to Australia at 0900UTC as the falling sunspot count has meant that this high frequency is no longer providing a reliable service. During our summer months the frequency could be reinstated on a trial basis, as other European broadcasters are still using this band to serve the South Pacific during our summer listening period.

At the other end of the band the BBC World Service is now using 6010kHz at 0400UTC replacing 5975kHz. At 0600UTC, when the transmission is

beamed to Australia, 7150, 9640, 11955 and 15070kHz give the best reception. After 0900, 11750, 15070 and 17705 are used, while the transmission at 2000UTC, for morning reception in this area, is heard on 9410, 11750 and 15070kHz to past 2200UTC. The BBC Waveguide program which updates frequency information on BBC broadcast is heard on Monday at 0915UTC.

KILOHERTZ OR MEGAHERTZ

Most international broadcasting stations make their announcements and print their schedules using kilohertz as the frequency reference. Some stations, including the BBC, continue to use megahertz, but it seems that a change is inevitable because of two major reasons. When stations use both medium and shortwave, the use of kilohertz means a continuation of the same frequency reference, while there is also a saving in space when the decimal point is removed so that 11955kHz takes less space than 11.955MHz. It is felt that if the BBC adopt the kilohertz reference, the other international broadcasters, who are now very much in the minority, will also make this change.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.

DO YOU WANT TO BE A RADIO AMATEUR?

The Wireless Institute of Australia, established in 1910 to further the interests of Amateur Radio, conducts a Correspondence Course for the A.O.C.P. and L.A.O.C.P. Examinations conducted by the Department of Communications. Throughout the Course, your papers are checked and commented upon to lead you to a successful conclusion.

For further information, write to

**THE COURSE SUPERVISOR
W.I.A. (N.S.W. DIVISION)**

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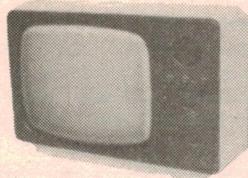


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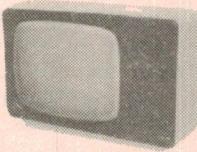
data cassette

Micron adjustable azimuth - data compatible cassette

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green screen video monitor

KAGA DENSHI



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WAS \$325
SAVE \$66

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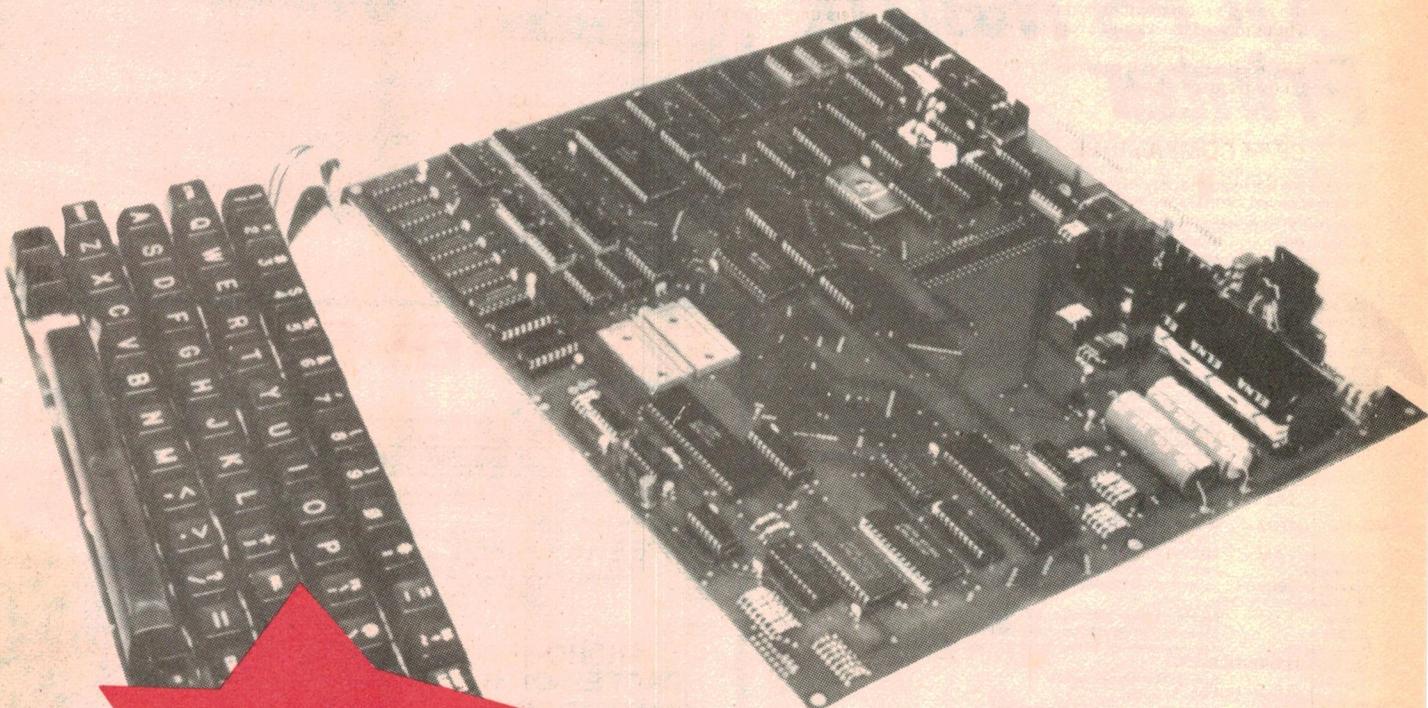
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COMPARISON CHART

	Excalibur 64	Microbee 32K	Apple II	Atari 800	Commodore 64	Tandy Colour
Base Price	\$399*	\$569	\$2100	\$1199	\$699	\$549
ROM	16K	16K	12K	10K	20K	8K
RAM	64K	32K	48K	48K	64K	4K
Colours	16	NO	15	16	16	8
Screen Display	40 x 24 or 80 x 24	64 x 16	40 x 24	40 x 24	40 x 24	32 x 16
Resolution	640 x 288	512 x 256	280 x 160	320 x 192	320 x 200	192 x 256
RF Output	YES	NO	NO	YES	YES	YES
RS232C	YES	YES	NO	NO	NO	YES
Centronics/Parallel Port	YES	NO	NO	NO	NO	NO
Extended Microsoft BASIC	YES	NO	YES	NO	NO	NO
CP/M Compatible	YES	NO	NO**	NO	NO**	NO
Power Supply Built-in	YES	NO	YES	NO	NO	NO

* Does not include case

**Will accept modified CP/M

TECHNICAL SPECIFICATIONS

CPU:	Z80A	Cursor:	Flashing block
Clock Speed:	3.5 Mhz	Video:	RF output or Direct video output
RAM:	64K	Keyboard:	Full size 64 key (QWERTY layout) 4 programmable function keys
ROM:	16K	Cassette Interface:	Built in: Software controlled at 1200 and 300 baud
Screen Memory:	2K (separate from User RAM)	I/O Ports:	Serial: RS232C Parallel: 8 bit centronics compatible
Language:	Extended Microsoft BASIC	Expansion:	2 expansion sockets providing all major Z80 control lines
Colour:	16 foreground and 8 background colours	Audio:	Programmable under BASIC
VDU Display:	24 lines by 40 characters 7 x 12 dot matrix (TV or monitor)	Power Supply:	On board
	24 lines by 80 characters 7 x 12 dot matrix (monitor required)	Optional Accessories:	Professional case. Disc controller board (kit form).
	Low resolution: 320 x 288 pixels High resolution: 640 x 288 pixels Dot bit addressable graphics		
Graphics Mode:	128 programmable characters 96 ASCII characters (upper and lower case) 128 graphic characters		

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REVIEWS OF RECENT Records & Tapes

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ELGAR VIOLIN CONCERTO: "A well worthwhile production"

ELGAR — Violin Concerto in B Minor. Itzhak Perlman (violin) and the Chicago Symphony Orchestra conducted by Daniel Barenboim. DGG Digital Disc 2532 035.

Elgar was a typical Englishman who happened to write music — fine music. This did not prevent him from drinking in the local with friends and placing a modest bet with the pub SP operator on what is described in court as a "contingency at . . .". He came of a musical family and played violin (his livelihood instrument), cello, bass, bassoon and trombone, the latter perhaps explaining the magnificence of his writing for brass.

His father was an organist who also ran a music shop and the boy grew up surrounded by good music. In his own scores, one of his favourite directions was "nobilmente"; much of his music was certainly that. But, except by name and reputation, he has always remained little more than "an English composer" outside his own country; this despite a brief period in Germany under the enthusiastic sponsorship of Richard Strauss.

Elgar wrote much passionate music but his passion was peculiarly English — governed by a certain "decent" reticence. All this leads up to the fact that Perlman's otherwise excellent performance of the Violin Concerto offers a much too emotional treatment of the first movement. It vibrates with so much passion that Perlman's instrument almost sounds as if it's sobbing!

Barenboim, in charge of the accompanying Chicago Symphony Orchestra suits his style to that of his principal. That aside, the technique of both soloist and orchestra is faultless, the balance fine, and the digital sound first rate, with a special mention of the clarity of Perlman's difficult double stopping.

The second movement brings more calmness to violin and orchestra alike, the latter producing some lovely massed string sound. By the way, my stylus got stuck in a groove in this section — a point to watch. Without the first movement's frenzy, the beauty of Perlman's tone can



"It vibrates so much with passion . . ."

BRITTEN, TCHAIKOVSKY: "Recommended"

BRITTEN — Variations on a Theme of Frank Bridge.

TCHAIKOVSKY — Serenade in C for String Orchestra. Australian Chamber Orchestra, Dene Olding, leader. CBS Masterwork Digital disc DBR 002.

Like the Sydney String Quartet, the Australian Chamber Orchestra has won an enviable reputation overseas. Founded seven years ago, it consists basically of 13 string players augmented from time to time — according to the composition played — by players of other instruments.

Usually conducted by the leader (first violin), in its expanded form it has performed under the baton of such celebrities as Neville Marriner, David Wilcox and Richard Bonynge and collaborated with such eminent soloists as Yehudi Menuhin and his late sister Hephzibah and others. It is a regular feature of the Adelaide Festival, makes frequent country tours of Australia and generally distinguishes itself wherever it goes.

The record under review is a good example of its first class discipline, its splendid unanimity, and its response to its violinist/conductor — or rather leader, since he uses no baton but indicates his wishes with his bow, and for that matter

be better appreciated. It does tend to coarsen a trifle in the fortissimos but this might be due to the recording. It is countered by this exquisite treatment of the pianissimos.

The Finale goes so fast that it reminded me of Heifetz at the height of his powers. Remember his Mendelssohn E Minor Finale? It is, however, without Heifetz' detachment. The highly scented emotional style of the first movement cannot possibly be used here or in the second movement either, so that it adds up to a well worthwhile production. (J.R.)

his posture. Out of a very wide repertoire it has chosen two popular pieces to record here.

The Britten has been popular with large and small organisations for many years. It is one of the composer's very earliest published works, commissioned while he was little more advanced than a student. It is no exaggeration to say that this work made his name, bringing him to the notice of a large public. His great talent and industry did the rest.

To those readers unlikely enough not to know, its variations embrace such diverse movements, among others, as a march, funeral march, Italian aria, Viennese waltz and a spirited fugue and finale. There are other movements too numerous to mention here, all full of happy inventions, some deeply felt. The ACO does justice to them all.

Contemporary dissonances are underlined to caricature a classical bourgeoisie. The Viennese Waltz would be disowned by the many Straussses responsible for theirs. It is comment at its most caustic. The work is full of good natured sarcasm and if the digital recording has the all-too-common fault of too wide a dynamic range for chamber music — and much of the other kind for that matter — the skill of the players provides adequate compensation.

On the reverse side, Tchaikovsky's Serenade for String Orchestra in C opens with just the right gush, followed by a

Reviews in this section are by Julian Russell (J.R.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

fast scherzo-like interlude presented with outstanding accuracy and verve. The second movement is rightly luscious and the Finale is spirited, with authentic Russian jollity. To be recommended to the most critical. (J.R.)

FRANCK, WOLF

... excessive emotion?

FRANCK — Piano Quintet in F Minor.
WOLF — Italian Serenade. Juilliard String Quartet, Jorge Bolet (piano). CBS analog Masterwork 74002.

The anti-romanticists seem to have selected Franck for the most bitter of all their attacks. Even his name is anathema and no credit is given him for the composition of that masterpiece, the Symphonic Variations for Piano and Orchestra.

Even at the first performance, the Piano Quintet was violently disapproved of by no lesser lights than Saint-Saens and Liszt. This however didn't prevent the mundane Saint-Saens playing the piano part in a public performance not more than about a year later — to enthusiastic public approval, I might add.

The basis of the Saint-Saens-Liszt disapproval was their opinion that the work was much too emotional to be genuine chamber music. This must have bewildered the gentle, modest church organist Franck, who used to play in St Clothilde, just behind what used to be the Australian Embassy in Paris.

The work is undoubtedly supercharged emotionally — a fact that is exaggerated by the ridiculously wide dynamic range of this recording which is strangely, for such a fault, analog and not



digital. I recommend a close watch on the volume setting while playing it. It is full of reminiscences of many of the composer's other works especially the Symphonic Variations in the D Minor Symphony.

After the steamy first movement, there is some very nice sound in the following quite Lento. As usual, the playing of the Juilliard and the pianist Jorge Bolet is impeccable. The work's full measure of passion will seem overdone only if you neglect to set the volume to suit the

BEETHOVEN — RAVEL

Sydney String Quartet

BEETHOVEN — String quartet No. 11 in F minor.

RAVEL — Quartet in F Major. Sydney String Quartet. Cherry Pie/Festival analog Disc LA 07720.

This disc has unusual interest for Australian record buyers. As the sleeve notes state, it was the first made by the new (1975) Sydney String Quartet; also the first classical release on the now eminent Cherry Pie label, always well recorded and now processed to Audiophile standards by Festival's special plant under their talented engineer, Max Harding, and distributed by them.

It was also the first string quartet recording made in the Recording Hall of the Sydney Opera House. Both Cherry Pie and Festival also express their thanks to Musica Viva for their very active support and promotion of the Sydney String Quartet which, in addition to its Sydney concerts, has made several Australian tours and successfully played at musical centres abroad.

In the tempestuous Beethoven, be careful how you adjust your gain to get the best from this otherwise beautifully sounding disc. All four parts are always clear and in perfect balance, and perfect too is the stereo separation. To verify

dynamic range.

But whatever reservations you might conceivably have about the Franck must surely disappear under the springlike influence of the Wolf Serenade. In the Juilliard's hands, it is deliciously nuanced with the most delicate of touches. The tempo is brisk and the effect is rather like that of a cool change after a steamingly hot day.

Despite an industrious output, including much orchestral work and the opera "Der Corregidor" — except for this Serenade — Wolf today is remembered only as a highly gifted song writer. Indeed, except for Richard Strauss, Wolf was just about the last of the great German lieder composers.

If you will indulge Franck's passion, you will find in the playing considerable recompense for the unlicensed dynamic range. (J.R.)

Worthy performance bu . . .

ROSSINI — Il Turco in Italia. Complete Opera. Samuel Ramey, Montserrat Caballe and others with the National Philharmonic Orchestra and Ambrosian Opera Chorus conducted by Riccardo Chailly. CBS 3 Digital Discs D3 37859. (3 discs.)



this, play the fugato section in the second movement. This deeply felt music comes off splendidly, as does the rest of the work. There is no question of its being up to international standards.

The players work their way from rage and despair to occasional sweetness and, in the Finale, to light. With analog recording of chamber music as good as this, digital would be hard pressed to offer more!

The Ravel was made at an appreciatively lower recording level but is just as sensitive. Although some of the changes of mood are a bit violent, I liked it better than the not-to-be-despised Debussy I reviewed recently. I'd like to emphasise that these lapses are very rare; otherwise the playing couldn't be more sensitive — and French sounding. This, until we come to the Finale which is much too loud and suggests still another level of recording. Well worth the investment, nevertheless. (J.R.)

This eminently worthy performance left me with one grave difficulty in reviewing it. I couldn't conceive it in terms otherwise than as a competitor to the Callas set — and Caballe is no match for that great, if mercurial artist. True, this set includes more of the witty original than did Callas' but much of the additional material is irrelevant and some of it plain boring. There is also the vexed question of the authenticity of some of it.

It would be cruel to emphasise just how far ahead Callas is of Caballe. In the matter of interpretation alone, Callas makes her Fiorella cunning, ironical and above all witty. Beside that, Caballe is pedestrian indeed. If you have the Callas set, just compare one short item, the cavatina "Non si da follia maggiore" and note the difference in characterisation. And this is only one of very, yes, very many weaknesses in Caballe's performance in the role.

Nor do the majority of the cast and the conductor, Riccardo Chailly, measure up to the standards set in the old (1955) Callas recording. On the other hand, the new set is attractively got up with a handsome brochure, four-language libretto and splendid portrait on the box. (J.R.)

Records & Tapes — continued

BARTOK — Sonatas Nos. 1 and 2 for Violin and Piano. Pinchas Zukerman (violin) and Marc Neikrug (piano). CBS Masterworks Digital Disc D36697.

Even those readers familiar with avant garde music will find these two sonatas difficult nuts to crack, especially the first. The reason for this is the diversity of the violin and piano parts. Particularly in the first, the two parts are so dissimilar that, although most readers have two ears, they will need to use them independently, as a chameleon does its eyes!

The difficulty is compounded by the nature of the instruments. Although the sound is very well recorded, the timbre of the violin will always tend to make it sound closer than the more powerful piano. True, this doesn't happen often here, but there are a few moments when it does upset the balance.

To add to these complications, there remain the technical difficulties of the parts themselves, although these are brilliantly handled by both performers. For instance, right at the beginning of the first movement of Sonata No. 1, the violin has a rhapsodic solo part over a quite independent piano part, yet after practice — and I must stress this — you will in time be able to separate them

spontaneously as you listen.

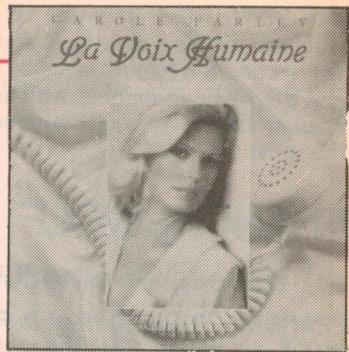
I realise that all this must be off-putting to potential buyers but these two works are important contributions to their genre and should be assimilated by anyone hoping for an understanding of contemporary music. There is an easier, quiet segment roughly in the middle of the first movement that calls for more sensitive treatment — and receives it. At first contact, try repeating this section a few times and you'll get well deserved encouragement.

While providing an exhibition of the virtuosity of the two players in handling their irreconcilable parts, it is also an example of the highest form of cooperation. Don't forget that, behind it all is the composer's earnest — and successful — efforts to make everything sound as dissonant as possible.

But, as I said before, don't be discouraged by these remarks. The compositions are too important to neglect. Good Luck! (J.R.)

☆ ☆ ☆

LA VOIX HUMAINE. Music by Francis Poulenc. Libretto by Jean Cocteau. Carole Farley, soprano, with the Adelaide Symphony Orchestra conducted by Jose Serebrier. Digitally mastered stereo, RCA VRL 1-6658.



Imagine a sparsely furnished stage, occupied by one lone young woman and a telephone. Unseen and unheard, at the other end of the line, is her former lover who has decided to abandon her and marry another in just two days time.

Interrupted from time to time by a poor line, and by other callers breaking into the conversation, she spends 40 minutes, posing, pleading, pretending, lying, but gradually being forced to the realisation that the affair is over.

This she can't accept and, in a final tragic moment, as she pleads with her beloved to hang up the phone, she winds the receiver cord around her neck and strangles herself — with traditional operatic finality!

The play was written by Jean Cocteau and premiered in Paris in 1932. The libretto was subsequently set to music by Francis Poulenc and presented at the Opera Comique in 1959, much to the delight of its original author.

It is presented here, with the Adelaide Orchestra, by Carole Farley, a widely experienced operatic soprano and one with a face and figure well suited to the role of a young woman in love. Hers is the task of building and sustaining the emotion, quite alone, over the whole 40 minutes. Hailed in the role overseas, she committed it to disc for RCA in the Adelaide studios of the Australian Broadcasting Commission.

Having said that, however, it is necessary to add that it will not be everyone's choice of a record. It is sung in French, but while a sheet in the jacket presents the English translation alongside the original French libretto, the words are uttered under such emotional stress, and often at such a rate, that they are not easy to follow, unless you happen to be relatively familiar with the language.

But then, arias abound in the world of opera which, although initially incomprehensible, can become a source of pleasure, with familiarity. I guess that there's no reason why this should not happen with *La Voix Humaine*.

The performance itself is of a high standard and the recording itself is of excellent quality. In short: one about which you'll need to make up your own mind. (W.N.W.)

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7400	23c	7414	45c	74LS11	23c	74LS123	30c
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7403	23c	7430	23c	74LS14	55c	74LS174	30c
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Records & Tapes — continued

THE LEGENDARY JAZZMEN. Volume three. Produced by Ron Wills. Vintage series RCA VJL-20410. Two-record album.

Start to play these two discs and you'll be in for some surprises.

The first is coincident with the opening phrases of Side one track one: Observing the endorsement "Vintage" and the fact that the track was recorded in 1938, one expects a few moments of surface noise, followed by an indifferent 1938 sound. But no; out of silence comes a firm, clean recording that has little about it to betray its age.

Surprise number two takes a little longer to register. Most of these recordings would have to be mono, yet they don't sound like mono, nor do they sound like the usual heavy-handed stereo re-processing. They simply have about them a certain subtle dimension when heard through an ordinary stereo system. On phones, they sound "within the head" but not all crammed up at the centre of the head. And, watching the stereo output bargraphs, differences are apparent between the two channels.

If the stereo effect is intentional, it is cleverly judged; if it's an accident, it is most fortuitous!

And, by that time, surprise number



three will have registered: the record will have "grabbed" you, even if you aren't a dyed-in-the-wool jazz fan. It's as good as that.

The four sides are given over to (1) "The Brass" — trumpet, cornet and trombone soloists; (2) "The Bass" — an unfortunate misprint which should read "The Brass" — continued; (3) "The Reeds" — clarinet and saxophones; (4) "The Rhythm" — piano, guitar, string bass and drums.

Most of the recordings were made in the period 1928-1941, although one goes back to 1926 and a few are from the '50s and '60s. All are apparently taken from RCA masters and this fact, along with modern technology, probably means that the music is heard to

better advantage today than when the 78rpm originals were available over the counter.

All told, there are 26 tracks featuring, up front, musicians who appeared in Vols one and two of this series (VJ2-0267 and VJ2-0337) but generally in a supporting role.

Inside this most carefully prepared album, Ron Wills has provided pictures of as many as possible of those "legendary jazzmen", plus succinct biographies, and a resume of each of the tracks on the four sides.

To be complete, I should really list the soloists, the bands and the track titles but that would really turn this into a catalogue. Let's just say that, if you're the slightest bit interested in jazz or vintage jazz, you owe it to yourself to seek out this album and see for yourself what it contains. It's a good one. (W.N.W.)

☆ ☆ ☆

UNSPUN SOCKS From A Chicken's Laundry. Spike Milligan. Stereo, Powderworks POW-4013. Distributed by RCA.

Don't feel bad about it if the title doesn't make sense. It didn't to me either, until I observed from the jacket notes that the songs and poems in this album are from "the famous Puffin paperback: Unspun Socks From A Childen's Laundry" ... whatever that means!

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The description "poems" is something of a euphemism; most of them are four-line quips that either have an odd twist or are so bereft of one that they gain a giggle on that account. The real point of the whole thing is Spike Milligan's crazy, odd-ball presentation.

The same general remarks apply to the "songs" except that, behind Spike Milligan's vocal goings-on is some very apparent straight musical talent.

If you're not a Spike Milligan fan, you'll probably wonder why grown people would bother to commit it to record. If the Goons have had a hand in your education, you'll better appreciate the efforts of this solus Goon. If you're a Spike Milligan fan, you'll probably love it! It all depends whether you yearn to know more about the Ying-tong-idle-l-po, The "veggy" lion or The Biddle-Box! (W.N.W.)

Telarc digital — Russian Themes

TCHAIKOVSKY: March Slav;

RIMSKY-KORSAKOV:

Russian Easter Overture;

GLINKA: Ruslan and

Ludmila Overture;

BORODIN: In the

Steppes of Central Asia;

GLIERE: Russian Sailors'

Dance. Leonard Slatkin,

the Saint Louis Symphony

Orchestra. Digitally

mastered stereo, Telarc

DG-10072.



This new release by Telarc should find ready and widespread acceptance with record buyers. By way of content, it provides a top-flight performance of representative examples of Russian orchestral composition. To the hifi enthusiast, it offers a wide variety of orchestral sound and exploits to the full the dynamic range of a modern LP disc, along with very clean sound and a minimum of surface noise.

The five tracks on the disc do not follow in the same order as listed in the title but are as set out below, each with helpful jacket notes about the composer and the composition; "Ruslan and Ludmila" — Overture (5' 16") composed by Mikhail Glinka (1804-1857): dashed off at the last minute and presented to the orchestra almost "before the ink was dry", the overture turned out to be very effective and a very popular "curtain raiser" to what was to follow; an effective introduction, also, to this album!

"In the Steppes of Central Asia" (7' 12") by Alexander Borodin (1833-1887): an orchestral sound tapestry depicting the passing of a caravan linking the Orient and Europe.

"March Slav" op 31 (9' 21") by Peter I. Tchaikovsky (1840-1893): stirring music with plenty of orchestral fireworks and massive bass that will give any system a workout!

"Russian Easter Overture" (14' 43") by Nikolai Rimsky-Korsakov (1844-1908): a descriptive overture which seeks to explore and present the Easter themes of the Russian Orthodox Church, along with the pagan inspired music and celebrations that permeated Christian rejoicing for the resurrection. It's a composition with a wealth and variety of instrumental sound; indeed, the work of an "orchestral virtuoso".

"Russian Sailors' Dance" (3' 35") by Reinhold Gliere (1875-1956): picture one of those incredibly agile groups of Russian dancers, on this occasion in sailors' garb, and gradually building up from a formal beginning to a frantic *prestissimo*. This is the music for just such a dance.

Need I say any more except to indicate where to enquire if you can't get it from your local speciality record store: PC Stereo Pty Ltd, PO Box 272, Mount Gravatt, Qld 4122. Phone (07) 343 1612. Recommended. (W.N.W.)

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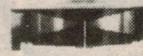


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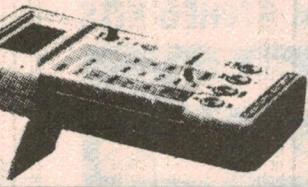
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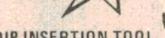
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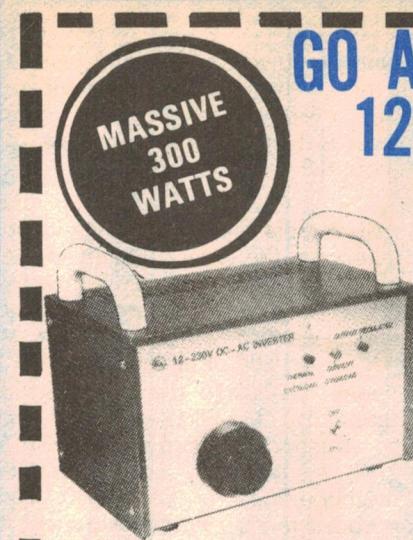
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7406	74LS122	.84	74S140	.45	4071	.36	ICL7106	17.50	WD1393	65.00	UA7805K	2.16	AC127	.60	2N301	4.30	2.2UF/35V	.35
7407	74LS123	.66	74S151	.130	4072	.35	ICL7107	18.00	WD1691	17.50	UA7806	.94	AC128	.20	2N597	.59	3.3UF/35V	.35
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7410	74LS126	.56	74S157	.140	4075	.36	ICM7217A	17.50	XR2207	5.50	UA7808K	2.38	AC188	.130	2N2219	.60	10UF/35V	.66
7411	74LS132	.54	74S157	.140	4076	.36	ICM7218A	18.00	XR2208	3.40	UA7812	.78	AD149	.210	2N2219A	.65	ELECTRO PCB	
7413	74LS136	.45	74S158	.120	4076	.34	ICM7555	1.95	XR2211	7.20	UA7812K	2.38	AD161	.170	2N2222A	.42	.1UF/50V	.15
7414	74LS138	.50	74S161	.48	4077	.34	ICM7556	2.70	XR2216	2.80	UA7815	.72	AF127	.125	2N2369	.60	2.1UF/25V	.15
7416	74LS139	.72	74S174	.126	4081	.34	L120	2.82	XR2240	3.00	UA7815K	2.38	BC107	.35	2N2484	.60	.4UF/25V	.15
7417	74LS158	.60	74S175	.126	4082	.34	L121	2.76	XR2243	3.20	UA7818	.82	BC107B	.40	2N2646	.96	10UF/25V	.15
7420	74LS152	.72	74S188	.280	4085	.80	LF347	2.18	BT26	2.34	UA7818K	2.38	BC108	.35	2N2647	.50	47UF/25V	.15
7421	74LS153	.72	74S189	.480	4086	.60	LF347	2.14	BT28	2.76	UA7824	.82	BC108C	.40	2N2894	.53	100UF/25V	.16
7423	74LS154	.140	74S194	.186	4089	2.70	LF351	.62	BT28	2.20	UA7824K	.238	BC109	.35	2N2904	.73	220UF/25V	.20
7425	74LS155	.72	74S242	.395	4093	.54	LF353	.94	BT28	2.20	UA7805K	8.30	BC109C	.20	2N2905	.73	330UF/25V	.35
7426	74LS156	.50	74S253	.140	4094	1.20	LF356	.66	BT28	2.30	UA7812	.78	BC117	.40	2N2905A	.73	470UF/25V	.42
7427	74LS157	.51	74S253	.130	4099	1.20	LF357	.125	BT28	2.30	UA7812K	9.95	BC117	.42	2N2906	.73	1000UF/16V	.45
7430	74LS158	.50	74S258	.140	4104	2.70	LF398	.475	BT28	1.40	UA789HGK	10.00	BC178	.42	2N2907	.50	1000UF/25V	.60
7432	74LS160	.86	74S283	.440	4160	1.00	LF398H	.650	BT28	1.40	UA78105	.45	BC179	.42	2N2907A	.50	2200UF/25V	.120
7437	74LS161	.84	74S287	.300	4161	1.30	LF13741	.86	BT28	1.50	UA78112	.50	BC212	.25	2N3019	.69	ELECTRO AXIAL	
7438	74LS163	.84	74S288	.290	4163	1.20	LH0002	10.95	BT28	2.02	UA78114	.50	BC218	.18	2N3053	.64	ELECTRO AXIAL	
7440	74LS164	.84	74S289	.500	4174	1.10	LH0042CH	9.60	BT28	2.00	UA78120	.65	BC237	.18	2N3054	.225	ELECTRO AXIAL	
7442	74LS165	.52	74S244	.91	4175	1.10	LH0071-1H	15.00	BT28	2.20	UA7915K	15.70	BC254	.18	2N3055	.130	1UF/63V	.20
7444	74LS170	1.00	74C00	.48	4194	1.10	LH0071-1H	17.50	BT28	2.30	UA7840	.350	BC547	.12	2N3302	.53	2.2UF/63V	.20
7445	74LS173	.80	74C02	.45	4195	1.20	LM104H	.650	BT28	2.30	UA7905	.96	BC547C	.18	2N3440	.113	3.3UF/25V	.20
7446	74LS174	.84	74C04	.40	4196	1.20	LM304H	.68	BT28	2.30	UA7905K	.235	BC548	.12	2N3441	.260	4.7UF/25V	.20
7447	74LS175	.75	74C08	.40	4197	1.20	LM310	.216	BT28	2.712	UA7908	.450	BC549	.12	2N3442	.278	10UF/160V	.35
7448	74LS190	1.06	74C10	.40	4199	1.40	LM332	.130	BT28	2.72	UA7908K	.550	BC549C	.12	2N3563	.18	1UF/16V	.20
7451	74LS191	1.10	74C14	.65	4201	1.50	LM331-14	.197	BT28	2.732	UA7912	.680	BC550	.12	2N3564	.18	1UF/63V	.25
7454	74LS192	.80	74C20	.46	4202	1.40	LM339	.205	BT28	2.764	UA7912K	.235	BC550C	.12	220UF/25V	.24	220UF/25V	.24
7472	74LS193	1.05	74C30	.58	4203	1.40	LM342	.195	BT28	2.816	UA7915	.400	BC552	.18	2N3566	.18	220UF/63V	.28
7473	74LS194	.96	74C32	.45	4207	1.40	LM347	.250	BT28	2.911	UA7915K	.238	BC557	.12	2N3567	.18	220UF/63V	.22
7474	74LS195	.84	74C42	.130	4208	1.40	LM348	.250	BT28	2.912	UA7915K	.238	BC557C	.18	47UF/25V	.25	47UF/25V	.25
7475	74LS211	.72	74C48	.165	4209	1.40	LM350	.160	BT28	2.920	UA7915K	.238	BC558	.12	2N3568	.18	47UF/63V	.29
7476	74LS211	.84	74C48	.165	4210	1.40	LM354	.160	BT28	2.920	UA7915K	.238	BC558B	.12	2N3638	.18	100UF/16V	.31
7477	74LS215	.75	74C48	.165	4210	1.40	LM355	.160	BT28	2.920	UA7915K	.238	BC559	.12	2N3640	.18	100UF/63V	.45
7478	74LS219	1.06	74C50	.40	4211	1.40	LM355	.160	BT28	2.920	UA7915K	.238	BC559B	.12	2N3641	.18	220UF/16V	.25
7479	74LS241	1.20	74C74	.90	4212	1.40	LM356	.160	BT28	2.920	UA7915K	.238	BC560	.12	2N3642	.18	220UF/25V	.35
7480	74LS242	.90	74C83	.220	4213	1.40	LM357	.160	BT28	2.920	UA7915K	.238	BC640	.40	2N3644	.18	47UF/16V	.48
7481	74LS243	.96	74C86	.150	4214	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640C	.20	2500UF/50V	.20	47UF/35V	.345
7482	74LS244	.160	74C89	.550	4215	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640D	.20	47UF/35V	.345	47UF/35V	.345
7483	74LS245	.180	74C90	.550	4216	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640E	.20	47UF/35V	.345	47UF/35V	.345
7484	74LS248	.55	74C91	.140	4217	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640F	.20	47UF/35V	.345	47UF/35V	.345
7485	74LS251	.72	74C92	.140	4218	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640G	.20	47UF/35V	.345	47UF/35V	.345
7486	74LS252	.220	74C92	.140	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640H	.20	47UF/35V	.345	47UF/35V	.345
7487	74LS253	.60	74C94	.180	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640I	.20	47UF/35V	.345	47UF/35V	.345
7488	74LS253	.65	74C94	.180	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640J	.20	47UF/35V	.345	47UF/35V	.345
7489	74LS253	.84	74C94	.180	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640K	.20	47UF/35V	.345	47UF/35V	.345
7490	74LS253	.96	74C94	.180	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640L	.20	47UF/35V	.345	47UF/35V	.345
7491	74LS253	.96	74C94	.180	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640M	.20	47UF/35V	.345	47UF/35V	.345
7492	74F00	.98	74C95	.195	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640N	.20	47UF/35V	.345	47UF/35V	.345
7493	74F02	.98	74C97	.120	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640O	.20	47UF/35V	.345	47UF/35V	.345
7494	74F04	.98	74C98	.190	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640P	.20	47UF/35V	.345	47UF/35V	.345
7495	74F04	.96	74C98	.190	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640Q	.20	47UF/35V	.345	47UF/35V	.345
7496	74F04	.84	74C98	.190	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640R	.20	47UF/35V	.345	47UF/35V	.345
7497	74F04	.80	74C98	.190	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640S	.20	47UF/35V	.345	47UF/35V	.345
7498	74F04	.80	74C98	.190	4219	1.40	LM358	.160	BT28	2.920	UA7915K	.238	BC640T	.20	47UF/35V	.345	47UF/35V	.345
7499	74F10	.98	74C92	.560	4219	1.40	LM64740	.160	BT28	2.920	UA7915K	.238	BC640U	.20	47UF/35V	.345	47UF/35V	.345
7500	74F11	.98	74C92	.540	4219	1.40	LM64733	.160	BT28	2.920	UA7915K	.238	BC640V	.20	47UF/35V	.345	47UF/35V	.345
7501	74F12	.75	74C92	.780	4219	1.40</td												

MAIL ORDER



GO ANYWHERE - 12-240V POWER \$199.50

These great Inverter kits enable you to power 240V appliances from a 12V DC power source. Tremendous for camping, fishing etc. Install into your Car, Boat or Caravan.

A fully regulated and overload protected design, featuring XTAL locked frequency. Use to power hi-fi, TV sets, even electric drills for short time periods.

MANY OF THESE KITS ARE NOW IN USE FOR EMERGENCY LIGHTING PURPOSES.

KIT features \star Gold plated edge connector and PCB huss \star Low age rate XTAL \star Sockets for all IC's \star High Efficiency Transformer

TWO GREAT 40 WATT MODELS

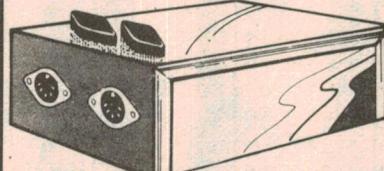


GENERAL PURPOSE

Suits small appliances, ie. Turntables, Tape Decks, Shavers etc. Variable frequency adjustment enables speed control of turntables. Works as a trickle charger when mains power is available.

EASY CONSTRUCTION \star VALUE PLUS

\$55.00

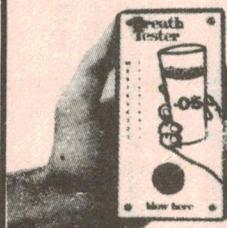


FLUORESCENT LIGHTING

Operates above the audible frequency range and is capable of driving one 40 watt or two 20 watt fluorescent tubes to 150% of their normal 240V efficiency. Install permanently into caravans. COMPLETE BOXED KIT, INCLUDING ALL WINDING WIRE.

\$37.50

ALCOHOL BREATH TESTER



ONLY

\$29.95

(SEE EA
MAY 1983)

This Great new Kit from EA will be a smash hit with all the smashed people at your next party. Fun to build. Fun to calibrate and Fun to use. More seriously, this unit could save lives.

THE EVER POPULAR MUSICOLOUR IV EA PROJECT



K5800

\$89.50

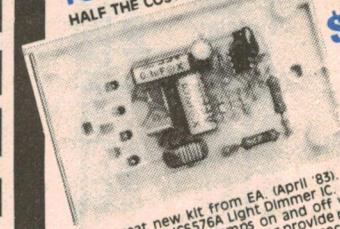
Combination Colour Organ and Light Chaser. Four channel colour organ. Internal microphone or connect to speakers for colour organ operation. (The lights connected to each channel pulse in beat to the music proportional to portion of frequency spectrum concerned.) Four chaser modes forward and reverse. Output lamp load capacity a massive 2400 watts — that's 100 party globes. Full instructions and every last nut and bolt included. Great for parties, shop signs, display windows etc.



ACTIVE ELECTRONICS
4 KING STREET SANDRINGHAM VICTORIA 3191
PHONE (03) 671137

PRESTIGIOUS NEW TOUCH LAMP DIMMER

\$19.50



Great new Kit from EA (April '83). Based on new Siemens IC576A Light Dimmer IC. Instantly turn lamps on and off with just a light touching on a wall panel or cover mood lighting by touching the panel for a few seconds. The Altronics Kit is complete in every way, including satin silver touch plates for that touch of class.

EPROM PROGRAMMER

\$55



\star ETI JAN '83

Versatile, low cost and easy to build. Plugs straight into the microbee I/O port. Suitable for 2716, 2732, 2532, 2732A and 2764 Eproms. Burn your games programmes and eliminate cassette loading time.

KIT FEATURES \star Sockets for all other IC's \star 1 x 2716 supplied — get started straight away \star Front Panel and Mains (SEC approved) transformer \star 28 pin and 16 pin wire wrap sockets to flush mount personality plugs (2 included) and ZIF socket (included) \star DB 15 Plug \star Complete to last nut and bolt.

RADIOTELETYPE DECODER

ETI APRIL '83



\$19.50

Display RTTY encoded messages on your Video Monitor. Receive up to date weather information, International News before the Papers, all sorts of coded military info. Simple circuit uses PLL techniques \star Single PCB Construction \star Kit includes DB15 Plug and backshell for connection to microbee \star Shielded pretinned PCB.

MAIL ORDER

MAIL ORDER

MAIL ORDER

50 & 25 YEARS AGO

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.



October 1933

ABC takes over 2UW: From the ownership of W. H. Paling and Company, Australia's largest music warehouse (the broadcasters of the first public concert to be transmitted in Australia in 1923) 2UW has this year passed into the control of the Australian Broadcasting Company, which provided the national programs for three years prior to the establishment of commission administration.

The studios and transmitter are being moved from Ash Street, Sydney, to the State Shopping Block, above the State Theatre, in Market Street. The new studios are most modern in design and equipment, even to the inclusion of an effects studio, which is playing a big part in the development of the new technique in radio entertainment which this station is perfecting.

☆ ☆ ☆

Garbled — but better than nothing: For the first time in history football fans throughout Australasia, and for that matter throughout the Empire, were enabled through the medium of shortwave wireless to listen in comparative comfort to a thrilling description of the first football Test, played by the Australians against England on a ground in the vicinity of London on Saturday afternoon, October 7. (In the early hours of Sunday morning, October 8, the first Test Match played in England by the "Kangaroos" was broadcast by the Australian Broadcasting Commission over the national network.)

☆ ☆ ☆

Television in three years: The BBC's announcement that it is ceasing its television broadcasts would seem to sound the knell of television.

It is pleasing, therefore, to hear that the BBC's decision does not mean that it has given television up as a failure: on the contrary, the three year interval will be given over to improving and refining the television processes with the object of producing a television set of efficiency equal to the talkie. (The forecast wasn't far out. The service started in 1937. Ed.)

☆ ☆ ☆

Early step up the ladder: Station 2BL's program for Saturday, October 28 was listed as a Radio Dance Night. Briefly mentioned was an "Associate Artist", J. Davey, crooner. The face in the accompanying photograph, young though it is, leaves no doubt as to the identity.

☆ ☆ ☆

Hardly cricket old chap! The French stations which were broadcasting British advertising in English have been told by the French Government that it is not quite the thing to do. This follows on protests from the British Government.



October 1958

Russian receiver powered by kerosene lamp: An ingenious Russian-built receiver has been produced for operation in the Middle East to receive broadcasts aimed at this part of the world. It uses one quart of fuel for each 8-16 hours.

The Russian set was built as a "poor man's radio" for the Middle East to enable the residents of these countries to pick up Russian radio broadcasts.

A thermocouple, mounted between the lamp's aluminium radiating fins, produces an output of 1.2 volts.

This is used for the filaments of the valves and to drive a vibrator power supply. The output of the vibrator

supply is 90 volts for valve plates and screens. The radio will continue to play even though lowered heat reduces the thermocouple voltage to about 0.8 volt.

☆ ☆ ☆

Giant radio telescope: A new radio telescope, the second largest in the world, is to be constructed for use by the CSIRO from 1961. It will help our scientists maintain their world reputation in the field of radio astronomy.

Some years ago the Radiophysics Laboratory of CSIRO proposed the construction of an instrument 200ft to 250ft in diameter, costing in the neighbourhood of £A500,000. The proposal received immediate support in Australia and overseas. In February 1958, it was decided to proceed with the design.

The site for the giant radio telescope must be in a region of the lowest possible electrical noise. A careful survey of sites within 50 miles of Sydney revealed none which would meet the stringent low noise requirement.

It was, therefore, decided to go into the interior and the choice finally fell on an excellent site near Parkes in New South Wales about 200 miles west of Sydney.

☆ ☆ ☆

TV for India: India will install a pilot television station in October to beam educational programs to villages round Delhi.

After months of research on closed circuits lent to India by foreign countries which exhibited at the 1955-56 Industries Fair here, the All-India radio will be ready to start television to a limited number of villages by early next year.

The pilot station will be installed in Delhi and will be received in the villages on community sets.

Widespread individual reception of television is not expected for many years yet as the cost of television sets is far beyond the reach of the average Indian's pocket.

☆ ☆ ☆

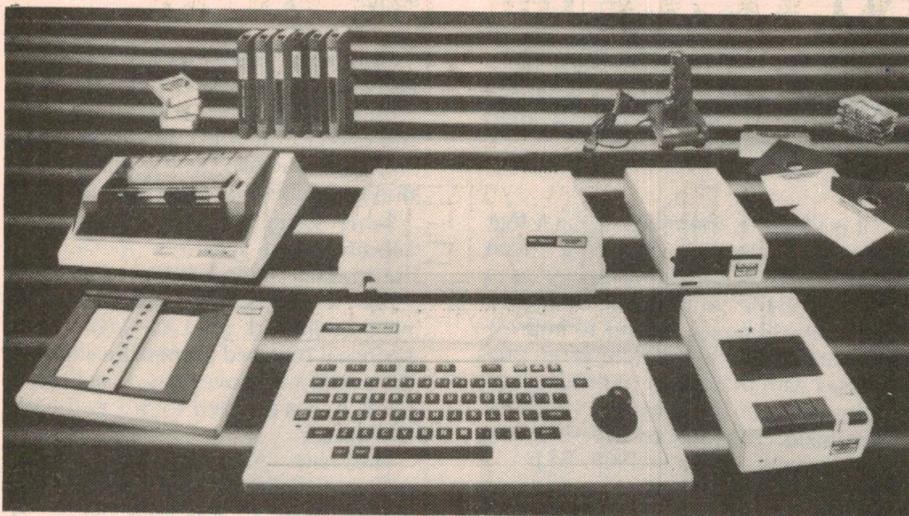
The smellies: A New York perfume company has fixed a date for release of the world's first film with scent effects.

It plans to waft scents suiting the moods of scenes into theatres through air-conditioning units.

A spokesman of the firm said an electronic apparatus attached to the film projector would set off scent sprays.

The first of the "scenties" would have no definite plot, but plenty of scent.

Micronews



Spectravideo SV-318 Computer

The Melbourne company, VideoActiv, are Australian agents for Spectravideo video games, and have recently introduced the Spectravideo SV-318 personal computer to Australia. Spectravideo is an American based electronics company with an affiliate, Bondwell, in Hong Kong.

The SV-318 computer is compact and constructed in a console unit with a keyboard and TV modulator. The keyboard unit can be conveniently linked with a full range of peripheral options or users devices through the SV601 Super Expander or an adapter to suit requirements.

Of particular interest will be the large memory capacity of the SV-318: 32K

ROM expandable to 96K ROM with a custom extended Microsoft Basic Interpreter built in. Also as standard is 32K RAM; 16K for graphics and 16K of user addressable memory. The SV-318 is designed to accommodate expansion up to a total of 144K of bank selectable RAM!

Other useful features include: Z80A microprocessor with 3.6MHz clock, CP/M compatibility, combined cursor/joystick control, easy loading cartridge slot, arcade quality graphics and sound, 71 key multi-function keyboard and built in word processor keys.

The SV-318 will be followed later in the year by the more powerful SV-328. Recommended retail price will be \$499.00.

Details from VideoActiv Electronics, 70 St Kilda Road, St Kilda, Victoria 3182. (03) 537 2000.

WordPlus — PC Word Processor

A new word processor for the IBM Personal Computer has been released in Australia by SCA Software Corporation of Australia Pty Ltd. Called WordPlus-PC, the system has been designed specifically for the IBM PC and "work-alike" computers and makes full use of the function keys of the IBM keyboard.

Supplied with WordPlus-PC are 10 adhesive labels to be affixed to the top of the function keys. The user does not have to remember or look up sequences of commands such as CTRL-K-J.

Features of the word processing program include global search and replace, cut and paste editing, three line headers and foot-notes and automatic

page numbering. One document can be printed at the same time as another is being edited and WordPlus also includes a powerful document merge facility at no extra cost.

WordPlus-PC can also be customised by the user to send its output to any of 40 different types of printer simply by selecting the appropriate menu entry. In particular, the Epson MX-80 dot matrix printer is fully supported by the program, allowing use of special graphics features and printing modes in conjunction with the word processor.

WordPlus-PC also supports on-screen formatting of documents. Words which are to be underlined or printed in bold face are displayed in that fashion on the screen. A key marked VIDEO allows the user to see exactly how a document will

"Hands-on" course by correspondence

The Australian School of Electronics Pty Ltd is now offering a practical "hands-on" course in microprocessor fundamentals.

Lessons are by correspondence, with the personal attention of a tutor available at all times to answer questions and help with difficulties encountered by students.

No previous knowledge of computers is necessary but previous training in basic electronics and transistor theory and circuits is required. Students with no previous training in electronics are required to undertake the school's course in basic electronics prior to beginning the microprocessor course.

A microcomputer trained based on the Z80 is supplied to each student participating in the course to ease the learning of fundamental machine code programming.

Fee for the course is \$390. This includes all hardware and software required, 11 lesson manuals and assistance from a tutor. Special rates are available for groups sponsored by firms and an Industrial Training Program is also available to companies.

Further details of the microprocessor course or the more fundamental electronics theory course are available from the Registrar, Australian School of Electronics, PO Box 108, Glen Iris, Vic, 3146. Phone (03) 523 5622.

look on paper: page breaks, margins, spacing, headers and footers are all displayed as they will appear in the printed document.

Recommended retail price of WordPlus-PC is \$395 plus sales tax. The price includes a user manual and advanced tutorial material, system disk, key-cap labels and an adhesive-backed card summarising all word processing functions. In addition SCA have set up a "Support Desk Hotline" which allows registered users of their products to get assistance over the phone telephone.

Stocks of WordPlus-PC are now being shipped to dealers throughout Australia. For further information contact SCA Software Corporation of Australia Pty Ltd, 449 Swanston St, Melbourne, Vic. Phone (03) 347 7011.

SUPERAED THE CP/M YOU'RE HAVING WHEN YOU'RE NOT JUST HAVING CP/M

In the first two years of manufacturing microcomputer systems AED became aware of many features that were not provided by the popular CP/M operating system. This shortcoming was holding back microcomputers from reaching their full potential in business, office automation, and engineering applications.

Analysis of alternative operating systems revealed that some had advantages in one area or another but still lacked the end user oriented features that were our primary concern. It appears that computer system programmers give total priority to computer hardware, disk file structures, programmers' facilities, and the command line power to impress engineers and technocrats. This explains why these new operating systems, while more powerful, still lack the basic facilities that would make the computer infinitely more useful to the businessman, engineer, doctor, etc., who uses it from day to day.

Solving this problem by designing a new op-system was out due to the incredible software base available for CP/M. Other companies' CP/M look-alikes all have compatibility problems and AED didn't want to join the list. The alternative of developing an extension package to the existing CP/M was adopted with some startling results, all achieved without corrupting one byte of CP/M or its CCP.

AED spent 12 months developing the first release of SUPERAED which was an immediate success leading to increased sales of the 'AED SUPERCOMPUTER I' and drawing considerable interest overseas. After a further 18 months development a new version with a unique multiple program selection capability ('MPS') was released, along with a new computer 'AED UNIVERSE Supercomputer II' which combined 8 & 16 bit operation in one machine.

SUPERAED provides many features unique to a CP/M based system including:

INTELLIGENT TERMINAL DRIVER. A special driver for the extremely fast AED UN-SERIAL terminal, providing display speed control and intelligent software control over cursor and all screen characteristics and attributes.

KEYBOARD SUBSTITUTION. Allowing application software to talk to the computer as though it were the operator. For the first time one program can use another to participate in the job at hand.

AUTOMATIC BACKGROUND MEMORY TESTING. SUPERAED continuously scans the computer's memory, warning the operator of any faulty cells before they can cause subtle date errors to creep in to your files.

SELECTION OF MULTIPLE PRINTERS. CP/M provides for only one printer. 'SUPERAED' provides for up to 8 printers which may be selected directly from the keyboard as well as under software control. Orders can be automatically directed to a printer loaded with order forms, invoices to a printer with invoice forms, etc.

A POWERFUL DIAGNOSTIC MONITOR. This is one of the most startling features of SUPERAED. Unlike other systems the monitor can be entered even when a CP/M application program is in use. After using the monitor for diagnostics, experimental, developmental, or debugging purposes, you can return right back to the CP/M application. At last you can look deep into the software and hardware system of your computer while the sample is still under the microscope.

MULTIPLE PROGRAM SELECTION (MPS). This is a unique feature of SUPERAED and the UNIVERSE Supercomputer II. It allows the user to jump from program to program and back again. This topic was covered in depth in the first article in this series (July).

Next month we present details of the Universe's Ultra Intelligent, Dual Centronics, Dual Serial, Clock/Calendar, Priority Interrupt, Programmable Timer, and Power Supply Monitor Card, which boasts 256k byte dynamically allocated buffer.



Sydney: AED COMPUTERS, 24 DARCY ST, PARRAMATTA, NSW 2150.
Phone: (02) 689 1744, (02) 681 4966. Telex: AA70664 GIRFRI.

Melbourne: AED COMPUTERS (MELBOURNE), ELSTON MICRO, 53 WAVERLEY RD, EAST MALVERN, VIC 3145.
Phone: (03) 211 5542. Telex: AA30624 ME447.

Canberra: AED COMPUTERS (CANBERRA), 217 NORTHBORNE AVE, CANBERRA 2601.
Phone: (062) 47 3403. Telex: AA62898 HARSUR.

UNIVERSE SUPERCOMPUTER II



SLOW: Non standard 5 1/4" discs.
SLOWER: 16 Bit only C.P.U.
LIMITED EXPANDABILITY: Cards from only a small number of manufacturers.
FEWER APPLICATION PROGRAMS: Due to 16 Bit only C.P.U.

We can help you with:
• CONSULTANCY • SERVICE CONTRACTS • CUSTOM SOFTWARE • STANDARD SOFTWARE

The choice is yours.

Microbee Speech Program

Mr Mark Daniel of South Australia recently sent us a copy of "easysBEEker", a Z80 machine language program which works with the MicroBee computer and the EA Compuvoice project and translates ASCII text to speech.

The program uses a series of rules to translate individual letters to appropriate Votrax phoneme codes and outputs and codes to a Compuvoice unit attached to the parallel port of the MicroBee computer. Any text typed into the computer or output by a program can be spoken by the Compuvoice, without laborious manual translation. Five different operating modes are available:

- Ordinary speech — words are pronounced in sequence, with punctuation marks serving to mark pauses in speech.
- Speech plus spoken punctuation — a “.” is pronounced as “full stop”, for example.
- A mathematical mode in which arithmetic symbols are spoken correctly — the full stop is pronounced “point” for example, and an asterisk is pronounced as “multiplied by”.
- A spelling mode — individual letters are spelt out.
- A Votrax phoneme mode in which only phoneme codes are accepted as input, to allow for fine tuning of pronunciation.

All modes can be selected at any time from within the text being spoken, and speed of pronunciation can also be varied from within the text.

The program is supplied on a cassette which loads into 4K of RAM at the top of the MicroBee's programmable memory space and is available in versions to suit 16K, 32K and 64K machines. Versions of the program can also be supplied in an EPROM, or re-located into any specified area of memory. Another special version includes phonetic pronunciations of all Basic keywords, and is intended particularly for the visually handicapped.

Connecting the Compuvoice unit to the MicroBee is easy, although it is essential to first modify the speech synthesiser to allow for a set-up delay on the STB line. The Compuvoice unit described in the June 1982 issue of EA should be modified as follows:

1. Cut the track leading to pins 3 and 4 of IC 2 (the 74121 monostable).
2. Connect this track to pin 5 of IC 2 instead of to pins 3 and 4.
3. Connect pins 3 and 4 of IC 2 to ground with a short length of wire.



Direct-connect 300bps modem

A new direct-connect 300bps modem that fits snugly under the base of a telephone has been released by Australian manufacturer Electromed. The new modem comes in a compact case the same size as a conventional telephone base and just 30mm high. It has been field-tested for almost a year by an independent evaluator and is Telecom approved.

Called the Sendata 300, the modem attaches to an existing telephone wall

socket plug and is fully operational at the flick of a switch. "It is by far the least complex direct-connect modem available in Australia and it is also the most simple to operate," says Electromed marketing manager Robert Powell. "In fact because of the success we have had overseas with our Sendata 700 Acoustic Coupler, we believe the new direct-connect modem will become a major export item for the company."

Recommended retail price of the Sendata 300 modem is \$240 and further information is available from Electro Medical Engineering Pty Ltd, 69 Sutherland Road, Armadale, Vic, 3143. Phone (03) 509 5844.

Re-programmed Video Games

A United States company, Romox Inc, has announced plans to sell video games cartridges containing EPROMs which can be re-programmed with a new game for a third of the cost of buying a new cartridge. Terminals installed at retail stores would program the cartridges while the customer waits, at a cost of around \$US10 per game.

The terminals would be linked by modems over the telephone lines to Romox's mainframe computer and will store the 10 top-selling games for each week in RAM, with additional

Two 560Ω resistors must also be added to the control lines of the Compuvoice to ensure that the unit is not falsely triggered by spurious signals on the MicroBee PIO pins. Both of these modifications are fully described in the instructions which come with the easysBEEker software.

In operation we found Mr Daniel's software to work extremely well, allowing for the "accent" of the Votrax chip. Approximately 85% of words are pronounced correctly, and the remaining difficult letter combinations

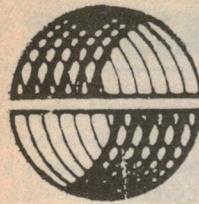
games on floppy disks. Romox, a large supplier of games cartridges (of the non-reprogrammable type) for the Atari 400 and 800 and Commodore's VIC 20 and model 64 computers, announced the scheme at this year's National Consumer Electronics Show in Chicago.

Company president Paul Terrell is optimistic about the plan. "There are tens of thousands of our customers out there with programmable cartridges. This is a substantial customer base, and I expect it to grow to millions as we sign up other software publishers. Electronic software distribution is here; it works; and it is going to totally change the way software is distributed."

can be improved by adopting a form of phonetic spelling, substituting letter combinations which are more easily pronounced.

The letter-to-phoneme translation algorithm used by the program involves examining each letter in the text and looking at a list of rules which determine how the sound of the letter is modified by its context. Once the rule that best fits the context of the letter is found the phoneme code(s) prescribed by that rule is sent to the speech synthesiser.

continued on page 130



SPHERE COMPUTERS PRESENTS

AN INTELLIGENT TERMINAL



Keyboard

- Detachable, capacitive, typewriter-style keyboard
- N-key rollover with auto repeat capability
- 4 LED indicators for caps lock, on line, block mode and keyboard lock/protect
- Audible keyclick enable/disable
- Auto repeat enable/disable
- Keyboard lock enable/disable
- Repeat rate 20 characters per second
- 5 cursor control keys, 10 editing function keys with 14-key numeric key-pad

Communication

- Code: 128 ASCII characters
- Baud rate: 75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19.200
- Parity: Odd, even, mark, space
- Operating Mode: Full duplex, half duplex or block mode
- Interface: EIA RS-232C or 20-mA Current Loop

Emulation

- LEAR SIEGLER ADM-3A, HAZELTINE 1500, ADDS VIEWPOINT

Screen Presentation

- Display format: 24 lines x 80 characters
- Display unit: 12-inch, non-glare Green CRT
- Character type: 7 x 9 dot matrix

SPECIFICATIONS

- Refresh rate: 50/60Hz
- Character set: 96 ASCII characters, 15 graphic symbols, 32 control character symbols

- 5 screen attributes: Blink, underline, blank, reverse, dual intensity
- Cursor type: Selectable slow, fast blinking or steady cursor, block, underline or invisible cursor

Editing Function

- Cursor: up, down, left, right, home
- Insert character, delete character, insert line, delete line, erase to end of line, page and field, field tab, field back tab, column tab, column back tab, block mode on/off, protect mode on/off, graphic mode on/off, clear unprotected.

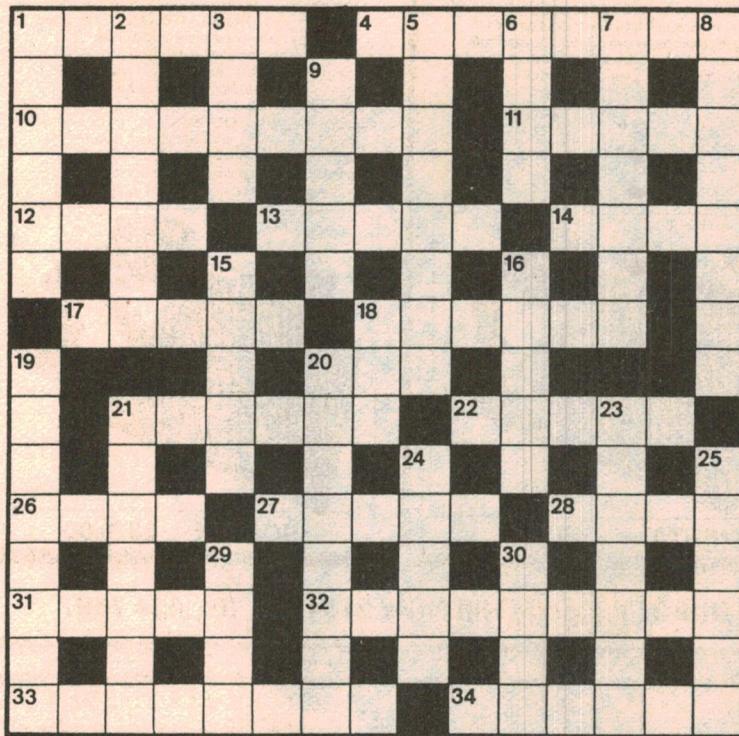
External Control

- Power on/off
- Contrast adjustment
- Baud rate
- Parity and data format
- End of message
- Emulation mode
- Refresh rate
- Half duplex or full duplex
- Auto line feed
- Auto new line
- EIA or 20-mA Current Loop
- Reverse video or standard video

ENQUIRIES FROM: AVAILABLE FROM OFFICES AND SHOWROOM PARIS RADIO ELECTRONICS, SHOP 1, 165 BUNNERONG ROAD, KINGSFORD, NSW 2032. POSTAL ADDRESS: PO BOX 380, DARLINGHURST, NSW 2010. TEL. (02) 344 9111. TELEX AA22579.

MAGRATHS ELECTRONICS 55 A'BECKETT ST, MELBOURNE, 3000 VICTORIA. TEL. (03) 347 1122.

OCTOBER CROSSWORD



DOWN

- Principles of electronics, rather than the practice. (6)
- Property of mass. (7)
- Input for a computer. (4)
- Radio broadcast. (2,6)
- Shown on a calendar. (4)
- Measuring instrument. (7)
- Device for removing insulation. (8)
- CRO control. (5)
- AC supply. (5)
- Kind of semiconductor in which holes are majority carriers. (1-4)
- Data storage unit. (3)
- MTBF: Mean time between . . . (8)
- Said of feedback which reinforces input. (8)
- An atomic pile. (7)
- Stipulations of operating conditions for components. (7)
- Paging sounds. (5)
- Current unit. (6)
- Equivalent state of a logical one. (4)
- Region of a parallel-plate capacitor with a non-uniform field. (4)

ACROSS

- Type of valve. (6)
- Kind of filter. (4-4)
- Charge carriers. (9)
- Interval recorder. (5)
- Degree of parameter change. (4)
- Abnormal increase in voltage. (5)
- Part of a staircase waveform. (4)
- Unit of capacitance. (5)
- Series of electronic scans. (6)
- Colour television system. (3)
- Type of access to a RAM. (6)
- Discharge. (5)
- Unwanted loss of charge. (4)
- Combines two frequencies. (5)
- Unitary constituent of an element. (4)
- Part of an electric motor. (5)
- Measurable quality of an AC circuit. (9)
- Shielded. (8)
- The Loch Ness monster. (6)

Micronews

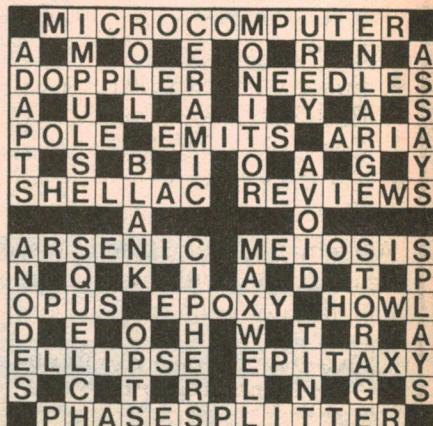
The rule-based approach allows the software to distinguish between the various sounds represented by a given letter in different contexts. For example the letter "e" produces a different sound in each of the words "met", "later", "measure" and "meat", and this difference is reflected by the easy BEEker software.

It is not practical to provide a rule for every combination of letters used in the English language, and some degree of mispronunciation is inevitable. EasyBEEker uses around one hundred rules, out of a possible 400 or so in order to keep the size of the program within manageable limits. After about a hundred rules the law of diminishing returns comes into operation — more and more rules must be added, each producing a smaller and smaller improvement in pronunciation.

There is a problem in assessing the intelligibility of synthesised speech. The longer one listens the more understandable the Votrax pronunciation is, although it also helps to know what the synthesiser is supposed to be saying. Others coming fresh to the subject find Votrax synthesised speech to be quite garbled. If one is willing to make a slight effort to comprehend the Votrax accent the speech is adequate for games, educational and hobbyist use. After all, it's 1000% better than a mute computer!

The standard easyBEEker program is available on cassette for \$14.95 including postage and packing while prices for specialised versions will be notified on application. A two-page summary of the program notes is available on sending a stamped self-addressed envelope to Mark G. Daniel, 8/45 Stonehouse Ave, Camden Park, SA, 5038. Phone (08) 294 8961.

Solution for September



STOP WASTING TIME TESTING BOARDS

MD will pin-point microtroubles in seconds. Portable and simple to use by non-technical staff in the REPAIR SHOP or on the PRODUCTION LINE. MD tests ROM, RAM & I/O and prints diagnostic reports. MICRODOCTOR can be plugged into an unknown system to perform a general diagnostic and print a MEMORY-MAP.

The ENGINEER may enter sequences of CHECKSUMS and RAMTESTS, READS and WRITES to specific MEMORY and I/O locations. SHORTING tests on DATA and ADDRESS LINES. PRINT-OUTS of memory in ASCII or HEX. These sequences are retained in CONTINUOUS MEMORY, available always at the push of a key.

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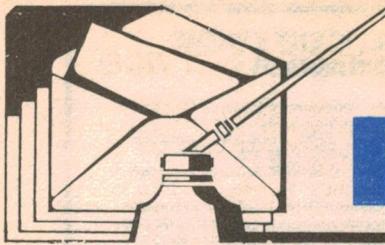
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Information centre

GARAGE LIGHT: "Kambrook" have just brought to the marketplace an inexpensive 240V lamp which switches on automatically for a predetermined time period by a movement (of a person or object) near the lamp. The circuitry would be useful for automatically lighting a garage when a motor vehicle enters, for lighting outside paths, porches and stairways, turning on an air exhaust fan in toilets, bathrooms, etc.

How about producing a similar project which could be less expensive and better (more convenient - no hands) than your Touch Lamp Timer described in August 1983. Perhaps you could also include an LDR to prevent the lamp being turned on in the daytime. (J.B., Warana Beach, Qld.)

• We will consider your suggestion. In the meantime, at least one of the applications listed by you could be fulfilled by our Driveway Sentry described in December 1982.

FRINGE VHF TV: I live in Byron Bay and this is a fringe area for VHF television reception from the Gold Coast. I have a Kingray VHF masthead amplifier and the best antenna of several that I have tried. The pictures received are basically very good on all channels, (0, 7, 8 and 9) channel 0 being the best.

The picture is watchable but has fine snow. Could you suggest any way in which I could get that little extra boost in signal to eliminate this snow. (W.M., Byron Bay, NSW.)

• There are several ways in which you may gain the extra signal you require. First, installing the antenna on a higher mast may give a worthwhile improvement. If you already have a tall mast though, any advantage of an even higher mast may be cancelled by signal losses in a long cable. A second approach may be to try a masthead amplifier with a higher gain although this may possibly result in more obvious snow.

A third possibility is to try stacking two identical antennas using a stacking kit especially designed for the job. You will have to approach your antenna retailer for information on this.

BALLAST RESISTOR: I have just completed and installed the Transistor Assisted Ignition with extended dwell period as was featured in the February

1983 issue, in a Holden HG Brougham. My first question is to the safety of the removal of the ballast resistor to either unit or coil.

Does it present some problems? I further intend to change over the distributor points with the Optoelectronics trigger circuit which I have already assembled. I have found that there is no supply of the 5401 quad two-input NAND gate and notice in the relevant article that no substitute can be accommodated.

This poses me a problem. Since McGrath's, Dick Smith, and other suppliers cannot be of assistance I am placed in the position of either giving up on the project or look for some form of assistance from you. Can you help me with your source of supply or recommend some other line of action? I always read your excellent magazine and without qualification recommend others to read it. (M.O., Moorabbin, Vic.)

• We would not recommend placing the ballast resistor inside the TAI case as its power dissipation will add to that of the TAI. Mount it on a bracket anywhere in the engine compartment where it will have some airflow from the fan over it.

Both Jaycar and Electronic Agencies stock the 5401 quad NAND Gate.

VIC 20 PROJECTS: I note that you have recently featured some projects for the System 80 and TRS-80 computers, namely the project to add Compuvoice to these computers.

I note also that to date you have not featured any projects for the VIC 20 computer which is becoming a very popular home system. I wonder if you have any projects for the VIC in the pipeline and in the near future.

My chief reason for writing is an article in the February 1981 issue on an RS232C printer interface for the System 80. I wonder if this project can be easily adapted to the VIC 20. What I had in mind was using I/O port but the diver software in the article would not be suitable - I wonder if this software can be adapted for the VIC 20 as the VIC has only one cassette port.

I would also be interested in a method of adapting the Compuvoice articles for the VIC 20. Hoping to see more of the VIC 20 in your magazine very soon. (B.S.F., Arana Hills, Qld.)

• The system 80 RS-232C printer interface could not easily be adapted to the VIC 20. As you note the software is entirely unsuitable, being for the Z80 microprocessor rather than the 6502 used in the VIC 20. The circuit details are

Conflicting views on CDI in rotary engines

ROTARY ENGINES: Regarding the August query on rotary engines, I would like to pass on the following information. All the top RX7 engines as raced by several leading drivers use two separate crankshaft-triggered CDI systems.

As far as using CDI systems on rotary engines I can only say, they need them badly. In fact the NSU RO-80 second model came from the factory equipped with a Bosch CDI. A fact not generally noticed is that they burn a two-stroke petrol/oil mixture and therefore need higher energy sparks to stop fouling.

The only figures I can quote regarding fuel consumption were taken roughly on a 13B bridgeported engine: city running using max RPM and caning the engine, 8mpg; country run with speeds up to 147mph and

driven very hard, 27mpg.

This was done using a 48mm Weber carburettor. (It out-dragged a Falcon GTHO.) I hope that this will be of help to C.J. (J.D., Prospect, NSW.)

ROTARY ENGINES: After considerable experimentation with CDI for rotary engines, my advice is: don't. Two independent units were used and the first problem arose with the leading unit sympathetically triggering the second. After a lot of work this problem was solved.

However, the results in operation were poor. I understand that the plugs are potted in the cylinders and the erratic firing seemed to bear this out. TAI would be a better bet and two units would be essential. (P.L., Invercargill, NZ.)

also sufficiently different as to require a complete re-design of the hardware.

There is a much easier way to achieve the same effect. The VIC 20 user port is defined in software as logical device number 2. Routines in the operating system provide proper timing and logic to send and receive serial data by this device using an assembly language program. The port can also be controlled from Basic, in the same way as a printer.

Try this:

```
10 OPEN 1, 2
20 CMD 2
30 PRINT "THIS STRING WILL BE SENT
    OUT OF THE USER PORT"
40 CLOSE 1
```

The OPEN statement sets up a communication channel (channel number 1) and "turns on" the logical device number 2 (the user port). The CMD 2 statement redirects the output of the program. Instead of appearing on the screen, anything PRINTed by a basic program will be sent to the device attached to the user port. The CLOSE command turns off the communications channel, and must be used at the completion of the data transfer.

However, you can't just hook up a serial RS232C printer to the user port. The circuitry in the VIC 20 does not provide the voltages specified by the RS232C standard ($\pm 12V$) but instead transmits data using TTL levels (0 and 5V). Thus the VIC 20 needs additional circuitry before it can be connected to an RS232C device.

Several articles in BYTE magazine for March, April and May of 1983 describe this circuitry in detail.

We suggest that you refer to these magazine articles for further information and directions for constructing the necessary interface circuitry.

The Compuvoice project can also be connected using one of the parallel ports provided by the VIA chip in the VIC 20. We can't go into details in a letter, but if there is sufficient demand from readers we may publish an article describing this procedure. Nick Hampshire's book "The VIC 20 Revealed" is an excellent reference on the features of the VIC 20, and may give you some guidelines on how to connect other devices to the VIC.

LIVE CHASSIS: I have doubts about using the EA Video amplifier described in August EA when used with a live chassis TV and RF modulator. On a recent model Sanyo with live chassis I measured 50 to 75VAC from the antenna socket to earth.

So, how much leakage, going to the modulator, could seep into the computer? To those people who have asked me about it I merely said, "I would not do it and suggest you don't".

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Generally I thought that there were capacitors between the "outside world" and the internals of live chassis TVs. (A.W., Maylands, SA.)

• We assume that you measured the AC voltage with a high impedance voltmeter such as a DVM. This probably had an input impedance of 10 megohms which would explain the high readings. This would represent a leakage current of around six microamps which hardly amounts to a hazard for computers or people.

IMPORTANT INFORMATION: While reading through Information Centre, EA Dec, 1983, p145, I was taken by your reply to JN Kainantu, PNG, re: Car Radio interference. I subsequently referred to your suggested article "Installing a car radio" EA, Feb 1969, p46.

My reason for writing is that I feel your magazine sometimes concentrates too much on minority problems at the expense of the important information. My experience over the years has been that a choke in series with the supply at the radio, cassette or R/T cures the majority of interference problems. One of my most successful cures involves using an old speaker transformer with the secondary used as the choke and the primary short circuited.

I appreciate that a choke cure was mentioned (near the end of the article) briefly but I disagree with the comment that filtering is adequate in most receivers as my practical experience has been to the contrary.

I was prompted to write this letter as I am constantly frustrated by reading articles, text books, etc, and finding that I come away with more unanswered questions than I started with and by the writer not having sufficient practical experience to be able to pinpoint or

highlight the most relevant sections of his articles. I suppose you will feel by this stage (if you have read this far) that I am nit picking, I assure you that there have been many such occasions, as this, where I have been tempted to comment.

I hope you will accept this letter as constructive criticism as in general I find your magazine most informative. (T.C., Baulkham Hills, NSW.)

• Re-reading of the suggested article indicates that while it did include some worthwhile hints it really should be updated to take account of today's car equipment. When that article was written most car radios would have been made in Australia and most would have included very comprehensive filtering on all leads, whether they were to the speaker, battery supply or antenna.

Your point about unanswered questions is well taken but it highlights the problem of the perceived audience: who will be interested by the article and will they be put off by the inclusion of too much basic information? That is a perennial question.

Notes & Errata

ELECTRIC FENCE (September 1983, File 3/MS/950: High gain BC338 transistors can cause the oscillator to operate in a spurious mode which results in excessive secondary voltage. This can blow the PUT or cause arcing at the output terminals. The cure is to increase the $10k\Omega$ bias resistors. Use the lowest value which will still permit reliable operation.

LCD 4½-DIGIT EVENT COUNTER (July 1983, File 7/CL/36): The $4.7\mu F$ capacitor is shown reversed on the PCB overlay diagram. The circuit diagram is correct.

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Nikola Tesla . . . ctd from p25

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This lecture was so successful that Sir James Dewar called on Tesla and asked him to repeat it before the Royal Institution. Tesla replied that he never duplicated his lectures, preferring to always present new and original material. Sir James then escorted Tesla to a room, pushed him into a chair and "poured out half a glass of a wonderful brown fluid which sparkled in all sorts of

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4510	38cm	Straight surround	8 or 15 Ohms	45	40-6000	100	\$84.00 or	\$156.00
4350	38cm	Hi-Fi	8 or 15 Ohms	30	30-4000	120	\$63.00 or	\$120.00
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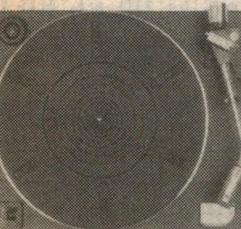
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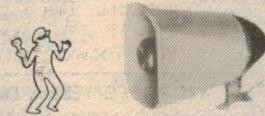
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EA PC BOARDS AND FRONT PANELS

Some readers have problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and their advertisements should be checked in the first instance. Failing that, below is a list of firms which produce or sell PC boards and front panels.

NSW

Dick Smith Electronics,
125 York Street,
Sydney, 2000.
Telephone 290 3377.
DSE also has branches
and resellers throughout
Australia.

Electronic Agencies,
115-117 Parramatta Road,
Concord, 2137.
Telephone 745 3077.

117 York Street,
Sydney 2000.
Telephone 29 2098.

Jaycar Pty Ltd,
125 York Street,
Sydney 2000.
Telephone 264 6688.

Radio Despatch Service,
869 George Street,
Sydney 2000.
Telephone 211 0816.

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

VIC.
Rod Irving Electronics,
425 High Street,
Northcote, 3070.
Telephone 489 8131.

Kalextronics,
101 Burgundy Street,
Heidelberg 3084.
Telephone 743 1011.

Shop 11,
Regional Shopping Centre,
Melton 3338.
Telephone 743 1011.

Sunbury Printed Circuits,
Lot 14, Factory 3,
MacDougal Road,
Sunbury 3429.
Telephone 744 2714

Altronics,
105 Stirling Street,
Perth 6000.
Telephone 328 1599.

Jemal Products,
8/120 Briggs Street,
Welshpool, 6106.

N.Z.
Marday Services,
PO Box 19 189,
Avondale, Auckland.

**Mini Tech Manufacturing
Co Ltd**,
PO Box 9194,
Newmarket.

Printed Circuits Limited,
PO Box 4248,
Christchurch.

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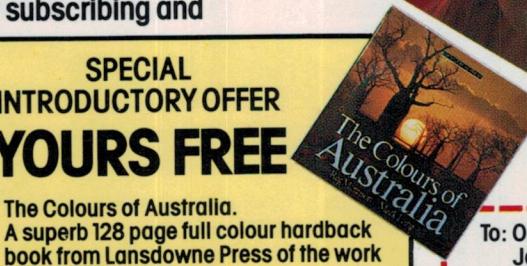
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